99 APRIL, 1934 No. 4

ANNALS of SURGERY

A Monthly Review of Surgical Science and Practice

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ANNALS *of* SURGERY

Vol. 99 APRIL, 1934 No. 4

THE KLIPPEL-FEIL SYNDROME*

By DeForest P. Willard, M.D., and Jesse T. Nicholson, M.D.

of Philadelphia, Pa.

The Klippel-Feil syndrome originated from a case report by M. Klippel and A. Feil in 1912. They formulated the following conditions: (1) Limitation of head motion. (2) Low margin of head hair. (3) Absence of neck. They believed the etiology was intra-uterine inflammation or trauma. Their subject was a forty-six-year-old male, a tailor by trade. At necropsy they found the cervical vertebræ fused and having a posterior spina bifida occulta. The mass did not contain either axis or atlas and was thought to be formed by dorsal vertebræ as there were four pair of ribs, and but eight normal dorsal vertebræ below it.

In 1919, Feil expressed a belief that the high spina bifida was the original lesion and that pressure and trauma later in fœtal life caused the fusion and malformation. He recognized three types: (1) Complete absence of cervical spine; (2) partial numerical reduction of cervical vertebræ; and (3) associated partial reduction extending throughout the spine.

An earlier report of this syndrome was by J. Jackson Clarke, in 1906, before the Clinical Society of London. He reported a male four years of age with head fixed, with chin close to sternum and no movements of cervical spine. He stated, "skiagrams showed extensive abnormalities in the form of bones in the upper dorsal and cervical regions, and a cervical rib was present on each side." He claimed operative treatment followed by massage gave natural movement. There was, however, no report of the operative procedure.

The two cases that we will report fall into the second group of Feil's classification: the first case by actual numerical reduction of vertebræ, and the second case by reduction of vertebræ due to fusion.

Case I.—J. S., a male, aged eight years, was the sixth of seven children. (Figs. 1 and 2.) There were no existing abnormalities in the other members of the family. He had a normal birth at eight months. His deformed neck was noticed in the second week. He was weaned at five months. He had no serious illnesses. He is under-nourished and under-developed. His head rests low between his shoulders; the hair line is low on the neck; there is marked nuchal depression. He has a rounded dorsal kyphosis. His trapezii flare out from the base of his skull to his shoulders. His scapulæ are elevated. His chin rests close to his sternum. His nipples are relatively low. Flexion and extension of his head are practically normal. Rotation is possible to 25° in either direction. Lateral flexion is somewhat limited. All motions of the neck are without pain. There is bimanual synkinesia or associated movements of the hands. Scratching, patting and writhing motions are carried out by the opposite hand with mirror-like precision. Reflexes are normal. His teeth have serrated edges. The two lateral

* Read before the Philadelphia Academy of Surgery, May 2, 1932.

upper incisors are unerupted and the two lower lateral incisors are behind the middle incisors. There are no other gross abnormalities. The Mantoux Tuberculin Test and blood Wassermann are negative.

The Röntgen film shows but six cervical vertebræ with fusion between the bodies of the first and second and partial fusion with the third. The spinous processes of the second and third vertebræ are united as are those of the fourth and fifth. (Fig. 3.) There is a posterior spina bifida occulta of the third and fourth vertebræ. (Fig. 4.) The other spinal vertebræ are normal except for the first sacral which shows a posterior spina bifida occulta.

CASE II.—S. W., a male, aged ten years, was the second in four children. His mother was an epileptic, but there were no other abnormalities in other members of the family. His past history was essentially negative. His deformity was not observed until his second year.

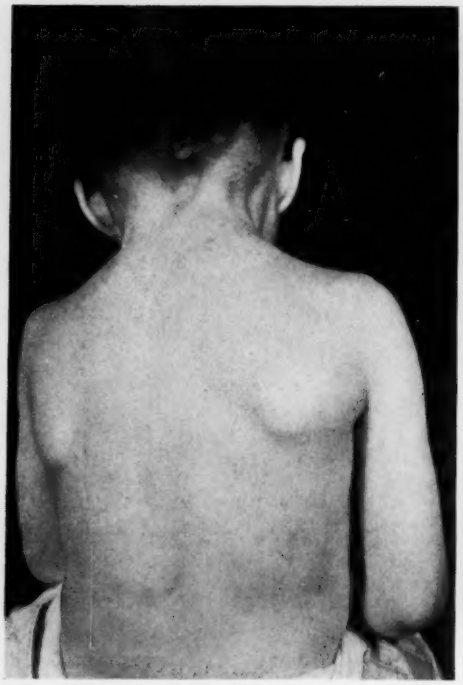

FIG. 1.—(Case I.) J. S. Head in flexion. Note low hair line, short neck, nuchal depression, winged trapezil, high scapulæ.

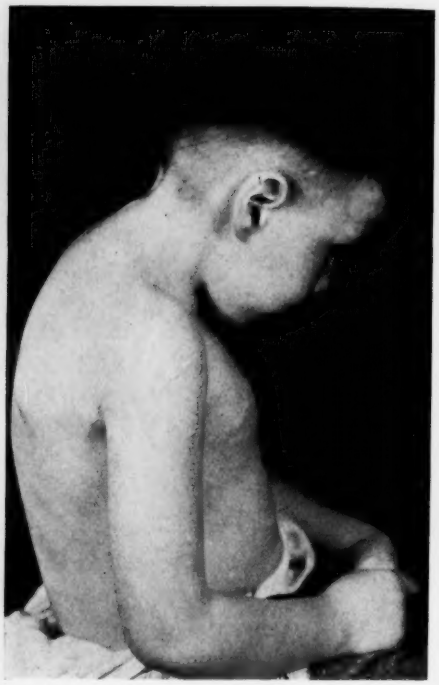

FIG. 2.—(Case I.) J. S. Showing prominent occiput, dorsal kyphosis.

He presents similar gross characteristics of the other case, but has a slight tendency toward a right torticollis. Rotation of the head is limited, other motions about normal. He does not have bimanual synkinesia. His von Pirquet test is positive, but blood Wassermann negative.

The Röntgen film shows seven cervical vertebræ with fusion of the first and second, and third and fourth vertebral bodies, with fusion of the spines of the second and third, and sixth, seventh cervical and first dorsal vertebræ. There is no spina bifida occulta. (Fig. 5.)

Etiology.—Of the sixty cases in the literature all have occurred spontaneously without history of familial malformations. The syndrome has occurred with about equal frequency in both sexes. De Beaujeur and Block

and also Ingelians and Piquet have reported hereditary syphilis as a factor. Both of these cases were deaf-mutes with mental deficiency. In the majority of reports syphilis was not questioned. Trauma has been mentioned as an explanation. The developmental deviations which take place before the third month of embryonic life are undoubtedly of influence.

Embryology.—Jamieson claims that ossification begins in the seventh week of fœtal life in the spinal arches and the tenth week in the bodies. Before the third month of development, therefore, distinct cervical characteristics essential to the shape of the adult osseous cervical vertebræ have occurred.

According to Bardeen, there are two bilaterally placed centres of chondri-

FIG. 3.—(Case I.) J. S. Six cervical vertebræ, fusion of first and second cervical bodies and fusion of spinous processes of second third and fourth and fifth.

fication for each of the vertebral bodies. Ventral fusion takes place before dorsal fusion. There are separate centres of chondrification for the neural processes from which develop the laminæ, articular and transverse processes.

The adontoid process represents the body of the first cervical vertebra. During the second month there is chondrification of the arches of the more cranial cervical vertebræ, at which time the atlas is fused to the axis and for a brief period; the bases of the neural arches of the axis and atlas, together with the tissue forming the occiput bone, become fused into a nearly continuous mass of pericartilage.

It appears that the malformation is determined before the third month of fœtal life. The posterior spina bifida is caused either by the later fusion

of the posterior chondrification centres for the vertebral bodies, or by the lack of fusion of the laminæ chrondrification centres. Due to faults in these laminæ chondrification centres, fusion of adjacent spinous processes occur. The apparent or actual reduction of cervical vertebra is brought about by faulty or complete fusion of the body chondrification centres in forming the continuous mass of pericartilage with the occiput. An extension of this abnormal fusion probably accounts for the changes which may appear in the upper dorsal region.

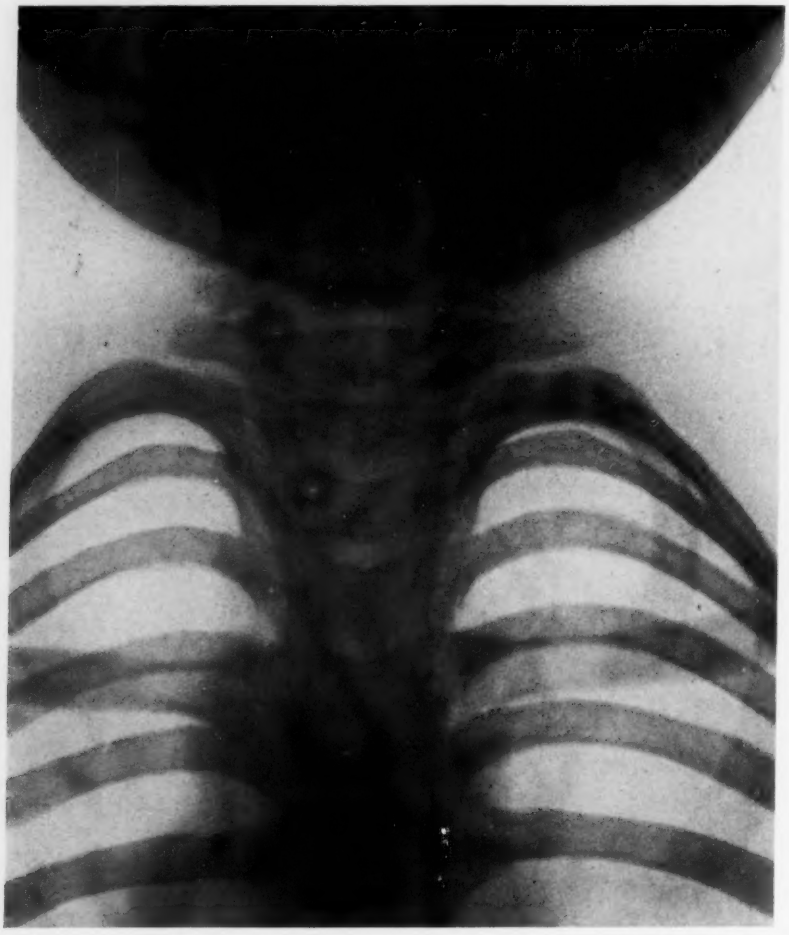

FIG. 4.—Posterior spina bifida occulta of the third and fourth cervical vertebræ.

Pathology.—The following additional variations occur in the reported cases of Klippel-Feil syndrome: (1) Usually fusion of atlas to occiput. (Heidecker.) (2) Fusion of first three vertebral bodies with fusion of spines of third, fourth and fifth cervical vertebræ. (Guillain and Mallaret.) (3) Fusion of the first and second cervical vertebræ with third intact and fourth, fifth and sixth fused. (Pierre Ingelians.) (4) Fusion of third, fourth, fifth and sixth cervical bodies and fusion of sixth and seventh cervical

and first and second dorsal spinous processes. (Elouson.) (5) Reduction to four cervical vertebræ. (Lavastine and Miget.) (6) All cervical vertebræ fused in one mass with four cervical ribs and reduction of dorsal vertebræ to eight. (Klippel-Feil.) (7) A posterior spina bifida occulta which may extend from occiput to thorax. (Nobel and Frawley.) (8) Fusion of six upper dorsal vertebræ. (Pytel and Saevic.) (9) A fusion of first and second right ribs and two ribs arising from the fourth left dorsal vertebra. (Ingelrans and Piquet.) (10) Fusion of the fifth lumbar and sacrum. (Ingelrans and Piquet.) (11) Dorsal spina bifida occulta and sacral rachichisis. (Ingelrans and Piquet.) (12) Oblique bodies of cervical dorsal vertebræ with a hemivertebra and unfused laminæ. (Ingelrans and Piquet.)

FIG. 5.—(Case II.) Fusion of first and second and third and fourth cervical bodies with fusion of the spines of the second and third and sixth and seventh cervical and first dorsal vertebræ.

Symptoms.—The physical characteristics are the apparent absence or shortness of neck, the low hair line on the back of the neck, the nuchal depression, the flaring trapezii, the high position of the shoulders, the prominence of occiput, the dorsal kyphos, the high scapulæ, the proximity of chin to sternum, the low nipple line, the limitation of head motion and freedom from pain.

The associated variations may be torticollis, asymmetry of face, scoliosis, Sprengle's deformity (Heidecker), absence of external auditory meatus (Ingelrans and Piquet), abnormalities of upper extremities—atrophy of left

forearm and hand (Pytel and Saevic), club hand (Ingelrans and Piquet), mental debility (de Beaujeur and Block), bimanual synkinesia or mirror movements (Bauman).

Diagnosis.—The cases may readily be mistaken for tuberculosis of the cervical spine. The differential diagnosis depends upon, first, the absence of rigidity; second, motion without pain; third, Röntgen film.

Treatment.—Heidecker states improvement in mobility after gymnastic exercise. Ryerson cites improvement in cosmetic effects in one case after division of the trapezius. Certainly, massage and stretching should be given a thorough trial early in the growth period and the associated deformities of torticollis scoliosis, club hand, *etc.*, corrected.

Prognosis.—Guillain and Mollaret describe a case, male, thirty-three years old, who developed a progressive spastic paralysis starting in the right leg and involving the left side twelve years later. Heidecker reports pain in old age due to plexus disturbances. All cases, however, which have come to necropsy have died of an acute infection. About fifteen adult cases have been reported. The oldest was seventy years.

Discussion.—There is no description of the cervical nerve abnormalities which would be expected with reduction and fusion of cervical vertebræ. There are few neurological symptoms reported. Bauman reported mental retardation, spasm of cervical muscles in two cases, and difficulty in swallowing or breathing in one case, and "mirror movements."

There are no previous accounts of these observations except mental retardation in two cases of mutism and hereditary syphilis. Our first case shows "mirror movements" or bimanual synkinesia. Purves-Stewart states that this may be physiological, especially in children, occasionally persisting into adult life. Rarely, it may be familial and is then regarded as a stigma of a neuropathical inheritance. Badgley points to imitative synkinesia in hemiplegics; voluntary movements of one side of the body tend to be reproduced symmetrically on the hemiplegic side. It, therefore, appears that the associated movements are extra-pyramidal in origin and are not caused by any abnormality in the cervical region.

CONCLUSIONS

(1) The Klippel-Feil syndrome is a developmental abnormality dating from the third month of fœtal life.

(2) Syphilis is incidental rather than etiological.

(3) Additional variations in other spinal vertebræ frequently occur.

(4) Other congenital abnormalities co-exist.

(5) Cases may be mistaken for cervical Pott's disease.

(6) The treatment is palliative.

(7) The deformity is not detrimental to longevity.

(8) "Mirror movements," bimanual synkinesia, are not characteristic of the condition.

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HISTAMINE THERAPY OF RHEUMATIC AFFECTIONS AND DISTURBANCES OF THE PERIPHERAL CIRCULATION

By David H. Kling, M.D.
of New York City

In 1931, D. Deutsch[1] reported very favorable results in 250 cases of painful affections of muscles and joints treated by galvanic cataphoresis of histamine over the affected parts. His findings were corroborated by Kopits,[2] Thrumpp,[3] v. Papp,[4] Friedlander,[5] Payer,[6] and supplemented recently by Vas[7] and Bettmann.[8] Failures of this method reported by Ruhmann[9] and Kaufmann[10] were plausibly explained by faulty technic.

No report in American literature has appeared as yet. This preliminary paper will therefore give an outline of the principle, the modalities and the temporary results of histamine treatment in rheumatic affections.

The Principle of the Action of Histamine on the Peripheral Circulation.—Recent investigations have emphasized the significance of disturbance of the peripheral circulation in the etiology of chronic affections of joints and muscles. Goldhaft, Wright and Pemberton[11] have produced osteo-arthritic changes in the knee-joint of the rabbit by interference with the normal blood supply. Spasm of the arterioles provokes myalgia, according to v. Papp. The elimination of the vasoconstriction by ramisection and sympathetic ganglionectomy gave good results in selected cases of rheumatoid arthritis, published from The Mayo Clinic by Hench, Henderson, Rowntree and Adson.[12]

Also, physiotherapeutic procedures produce beneficial effects in rheumatic affections chiefly by a temporary increase of the blood supply. According to Lewis,[13] every irritation liberates in the tissues a histamine substance which he regards as the hormone regulating the peripheral circulation. Deutsch conceived, therefore, the idea to supply directly the affected parts with histamine and thus overcome a possible deficiency more efficiently than by the usual physiotherapeutic measures.

A simple experiment demonstrates the powerful influence of histamine on the peripheral circulation. A drop of 1 to 1000 histamine solution is placed on the skin, which is subsequently pricked by a sharp needle. Within five minutes an urticaria wheal develops surrounded by a red flare. The response of the peripheral circulation consists of a triple reaction: first, there is a local dilatation and an increase in the blood flow in the minute vessels (purple spot); second, a local increase in the permeability of the capillaries, which produces the wheal; third, a widespread dilatation of the surrounding arterioles (flare).

The distribution of histamine over the affected part in rheumatic conditions will therefore result in a comprehensive alteration of the peripheral circulation in the diseased parts.

Technic of the Histamine Application.—(*a*) *Cataphoresis.*—Deutsch devised for this purpose a special galvanic apparatus and used leaf impregnated with histamine in conjunction with it. This outfit, called Katexon and Katexon leaf, is not yet available here. The following technic was therefore adapted. A reliable galvanic apparatus equipped with an accurate milliammeter supplies the electric energy. For electrodes aluminum or lead leaf is used. Filter paper or gauze is moistened with a solution of histamine acid phosphate of 1 to 1000, dissolved in 0.1 per cent. chloretone for preservation. The affected part is covered by the filter paper, over which the positive electrode is adjusted and secured with rubber bandages. On account of the danger of producing burns, care must be taken so that the electrode should not touch the bare skin and all metal should be removed from the vicinity of the current. A very convenient negative electrode consists of a non-metal basin filled with weak saline solution. A strip of lead leaf connected with the positive pole is adopted to the bottom of the basin and covered with a rubber sheet. One hand is submersed in the basin of saline. The current is slowly built up from four to eight milliamperes, allowing about one milliampere to the square inch of positive electrode. It is permitted to act from one to two minutes.

In the majority of cases, no more than a prickling sensation is felt over the treated part. The current is gradually decreased: contact should not be interrupted suddenly.

The sequence of effects of the histamine cataphoresis was studied on patients and in self experiments: The exposed skin appears reddened immediately after removal of the positive electrode. Soon wheals crop up and blend into one patch of urticaria, which stands out whitish from the surrounding erythema. (Fig. 1.) The temperature over the treated parts is raised from 2° to 3° C. Gradually, the elevation of the skin recedes, leaving red spots. The skin does not return to its normal appearance before five to six hours.

Bettmann has studied the capillary changes and found a marked increase in the rate of circulation and in the number of capillaries visualized and dilatation of the subpapillary vessels. He demonstrated the marked influence on resorption experimentally on the skin of rats, subjected to cataphoresis of 10 per cent. natrium iodide solution with preceding histamine application. Controls treated only with iodine cataphoresis showed in the section particles of iodine precipitated with thalium acetate in the superficial layers of the corium, while the sections of the skin which were subject to preceding histamine cataphoresis showed iodine particles scattered through all layers. Another evidence of the effect on deep vessels of the histamine was furnished by Zsedenyi and quoted by Kopits: After ligation of bleeding vessels, in the course of an operation, histamine was applied to the skin adjoining the incision. Thereupon fresh bleeding occurred from deep small vessels. This permitted an exact hemostasis.

(*b*) A modification of the histamine cataphoresis was recently published by Bettmann.

A non-metallic (glass, enamel) basin is filled with a 1 to 10,000 solution of histamine and connected with the positive electrode and insulated by covering it with rubber sheet. The affected extremity is submersed in the histamine solution. The negative electrode is wrapped in insulating material (linen, towels or rubber) and applied as a cuff above the treated part. The current is permitted to act for five to ten minutes. This method is very convenient in affections of the hand and foot. Drawbacks are the large amounts of fluid necessary and frequent renewal as the solution deteriorates in from one to three days. The reaction, also, is not so strong as with the former method.

(*c*) *Scratch Method.*—In cases where galvanic apparatus was not at hand I have used the following method of application of histamine: The skin is

cleansed with gasoline or ether; with a sharp pointed instrument deep scratches are drawn over the affected area in vertical and horizontal directions at intervals of one-fourth of an inch. The whole area is thus divided into small squares. A piece of gauze is saturated with the 1 to 1000 histamine

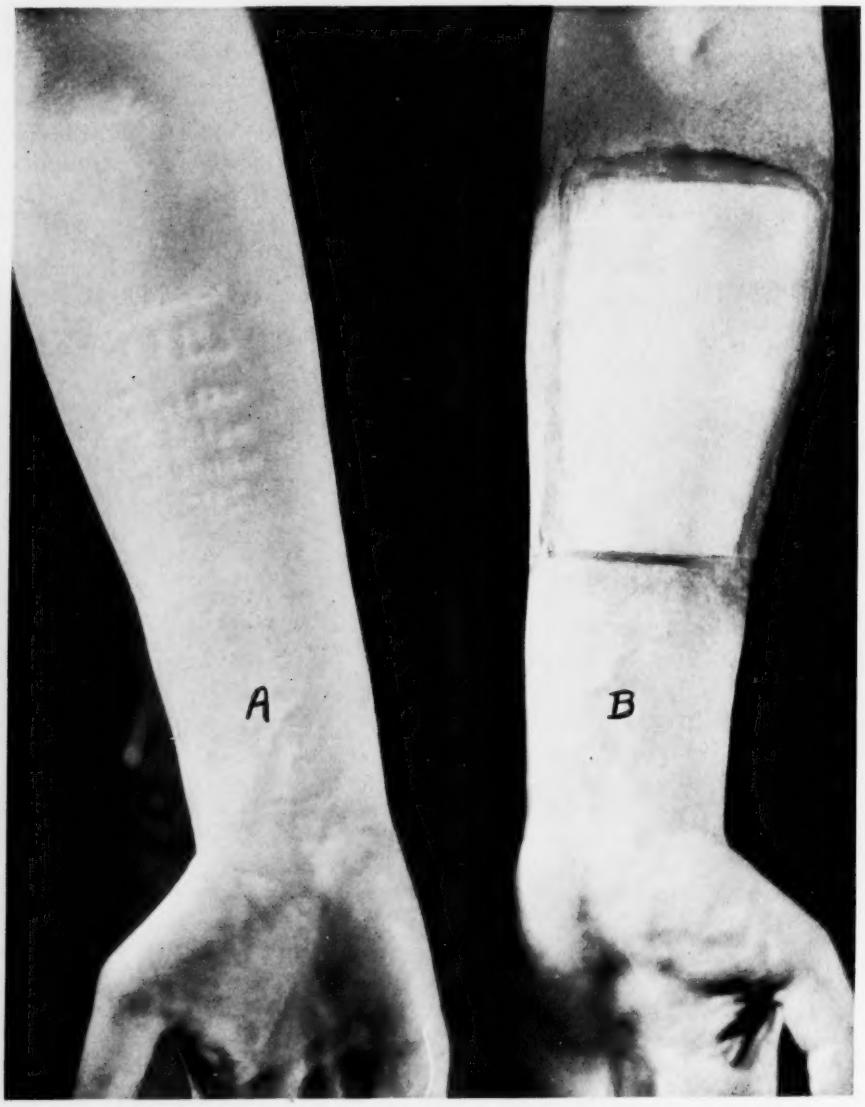

FIG. 1.—Histamine application. (A) Scratch method; squares formed by strips of urticaria. (B) Cataphoresis; a continuous patch of urticaria, outlined with charcoal.

solution and rubbed into the scratches. Soon erythema appears and stripes of urticaria develop corresponding to the scratches. (Fig. 1-A.) The changes on the skin and the therapeutic effects are equal to the ones observed with the histamine cataphoresis. The advantages of this method are simplicity and time-saving. It is also of value as it proves that the action of histamine is

independent from the electrical current; thus it refutes the contention of Kaufmann that the analgesic effect of this treatment is due to the action of the positive pole upon the tissues. Disadvantages are the persistence of the scratches for about a week and it is therefore only used on covered parts.

TABLE I

Summary of Histamine Therapy Results

Diagnosis	No. Cases	Cured or Improved	%	Failed	%	Recurred	Remarks
Myalgia.....	316	301	95.6	15	4.4	26*	*out of 151 cases
Static and traumatic myalgia.	34	31	91.1	3	8.9		
Contractures....	29	20	69.0	9	31.0	16	
Joint affections..	94	85	91.3	9	8.7	21*	*out of 56 cases
Acroparesthesia..	20	18	90.0	2	10.0		
Neuralgias.....	32	23	71.8	9	28.2	3*	*out of 13 cases
Miscellaneous...	29	29	100.0	0	0.0	5*	*out of 10 cases
Totals.....	554	507	90.8	47	9.2	71*	*out of 230 cases

Indications and Therapeutical Results.—Table I presents a compilation of the available data on histamine treatment of rheumatic conditions. Out of a total of 554 cases, 507 (90.8 per cent.) were either cured or improved; forty-seven cases (9.2 per cent.) were not benefited. However, in a series of 230 favorable cases, reported by Deutsch and Kopits, the relief was only

TABLE II

Analysis of Results of Histamine Therapy

Condition	Author	Total Cases	Cured or Improved	%	Failure	%	Recurrence	%
Myalgia.....	Deutsch.....	94	89	95.7	5	4.3	14	16.7
Myalgia.....	Thrumpp....	100	98	98.0	2	2.0		
Myalgia.....	Kopits.....	57	56	98.2	1	1.8	12	21.4
Myalgia.....	Vas.....	45	40	88.9	5	11.1		
Myalgia.....	Kling.....	20	18	90.0	2	10.0		
Traumatic myalgia	Deutsch.....	6	6					
Static myalgia...	Vas.....	28	25	89.3	3	10.7		
Neuralgia.....	Deutsch.....	3	0	0.0	3			
Neuralgia.....	Kopits.....	13	9	69.3	4	30.7	3	33.3
Neuralgia.....	Vas.....	16	14	87.5	2	12.5		
Arthralgia.....	Deutsch.....	4	4					
Arthralgia.....	Kopits.....	3	3					
Chronic arthritis deformans	Deutsch.....	23	20	87.0	3	13.0	2	10.0
Chronic arthritis deformans	Kopits.....	10	10	100.0	0	0.0	5	50.0
Polyarthritis....	Deutsch.....	16	14	87.5	2	12.5	14	100.0
Joint diseases....	Vas.....	38	34	84.5	4	10.5		
Acroparesthesia..	Vas.....	20	18	90.0	2	10.0		
Contracture.....	Kopits.....	29	20	69.0	9	31.0	16	90 0
Miscellaneous..	.....	29	29	100.0	0	0.0	5	

temporary in seventy-one (30.9 per cent.) cases. This high percentage of recurrences was partly due to insufficient treatment in the experimental stage of the method, and to its application in conditions where only symptomatic effect could be expected. On the hand of Table II, which gives a survey of the results by each author, the present status of this treatment will be analyzed.

Myalgia (Myositis)—Three hundred sixteen cases, representing over 56 per cent. of the total, belong to this group. Pain, tenderness and limitation of motion due to muscle spasm are the chief symptoms. Sometimes distinct hardening can be palpated within the muscle in the vicinity of the insertion. (Myogelosis.) The onset is rather acute and frequently provoked by exposure to temperature changes or by prolonged exertion of the muscle group. The short time since introduction of the histamine treatment permits an evaluation of the effect only in relatively acute conditions which present a definite yet simple clinical picture. This explains the prevalence of the reports to date in painful affections of the muscles.

For the same reason only twenty cases of myalgia of my own observation can be presented here. Duration of the symptoms amounted from one week to two years; the age ranged from twenty-eight to sixty-seven years. Previous treatment was given without success in eight cases, and consisted of baking and massage and diathermia. The muscles of the shoulder were affected in fifteen, of the arm in two, of the forearm, neck and calf in one case each. Cure or improvement was achieved in eighteen (90 per cent.); two cases remained unrelieved. No other treatment was given during the histamine therapy. The results are in good agreement with these published by the other authors which reported success in 90 to 95 per cent.

A thorough examination of all muscles of the affected part for pain, tenderness, contraction and nodules is of the utmost importance for success of the treatment. It is a common occurrence, for instance, that myositis of the trapezius muscle is diagnosed, while further examination would have detected tenderness and spasm of the deltoid and the pectoralis insertions as well. All affected muscles and the antagonists must be treated.

The effect of the treatment is very striking. Immediately after the very first application, pain and tenderness disappear and motion is increased. In case this initial effect is not pronounced, the final outcome must be viewed with scepticism. This analgesic effect remains first for several hours, corresponding to the changes in the circulation described above. The treatment is therefore repeated at first daily if possible; with the progress of the recovery, the painless intervals increase up to twenty-four to forty-eight hours. Treatment is now continued every second to third day, until all symptoms have disappeared. The number of treatments required varies from three up to twenty. In severe and chronic cases one is justified to continue as long as there is good immediate response to the treatment. As illustration four abstracts of histories are given:

CASE I.—L. O., fifty years of age, white, housewife. Since three months, pain and tenderness over the right shoulder; limitation of abduction and elevation of the right arm. Diathermia and massage did not bring relief. *Examination.*—Tenderness over the trapezius and insertion of the deltoid muscles, which disappeared immediately after the first treatment. She returned with the statement that she was able to spend the night free of pain for the first time since the onset of the condition. Pain relieved permanently after the first treatments, but tenderness did not subside completely before the seventh application of histamine.

This case shows a prompt success of histamine after failure of diathermia and massage.

CASE II.—F. O., forty-four years of age, white, housewife. Four years previous, treated for calcified subacromial bursa of the right shoulder. Since one week, pain, tenderness and limitation of motion of the left shoulder. Menopause with thirty-five years; dermographismus and acroparesthesia of the fingers. *Examination.*—Left trapezius and deltoid and pectoralis are contracted and very tender to touch. Motion is restricted in all directions by the muscle spasm; maximum of abduction 40°. After the first treatment tenderness disappeared, motion increased, abduction 120°. Recovery complete after four treatments.

This is an illustration of prompt recovery of an acute attack in an individual predisposed to rheumatic affections and circulatory disturbances.

CASE III.—C. R., forty years of age, physician, white. Since four weeks, pain in left shoulder, increased on motion of the arm. While driving he is in the habit of leaning the bend of his arm out on the window and assumes that this exposure to weather and pressure have brought on this condition. At the first examination, a hard and tender node the size of a hazel-nut was found at the insertion of the deltoid muscle. The first treatment was given over this area alone. Immediate disappearance of pain and tenderness lasting for several hours. The nodule in the deltoid was not more palpable when he returned two days later, but there was still pain on motion of the left arm. The reëxamination revealed tenderness and contracture of the cervical portion of the trapezius and the insertion of the pectoralis muscles. The symptoms disappeared after three treatments. This case shows the importance of a thorough examination and treatment of all the affected muscles.

CASE IV.—A. K., forty-five years of age, white, sign painter. Since eight days pain in the right elbow increased on motion. No evidence of lead poisoning. *Examination.*—The elbow-joint is normal, but tenderness present over the head of the flexor carpi communis. There was only slight decrease of pain and tenderness after the treatment, and no permanent relief after three applications.

The reason of the failure in this case could not be ascertained, as the patient discontinued the treatment.

Muscle Affections Following Trauma, Static Strain or Disease of Bone and Joints.—Successful treatment of pain and muscle spasm following trauma was reported by Deutsch in six cases; Thrumpp published eighteen cases with recovery in seventeen. This result, if confirmed in a large series, would indicate a great progress in the after-treatment of injuries to extremities.

In static myalgia chiefly due to weak feet, Vas reported good results in twenty-five out of twenty-eight cases. In contractures of muscles, due to bone and joint affections, Kopits had improvement in twenty-nine cases; however, in sixteen cases, the results were only transitory. Although the treatment in this group is only symptomatical, it could be made use of to correct faulty position in preparation of final measures.

In three cases of calcified subacromial bursae, verified by röntgenograms, I have seen disappearance of pain, tenderness and return of complete motion after three to six treatments.

Arthritis.—Ninety-four cases of different types of arthritic conditions are listed. In eighty-five cases, improvement was noted, which, however, was only transient in twenty-one cases. The results are inconclusive on account of the small number of cases and the indefinite nomenclature used. (Deutsch and Kopits refer to their cases as arthritis deformans and polyarthritis; Vas writes of "joint diseases.") I have under treatment a group of cases of osteo-arthritis and of rheumatoid (atrophic) arthritis. In some cases of the former, I have noticed a decrease in hypersensitivity and stiffness. In the second group some improvement in motion and decrease of pain occurred after treatment. However, prolonged observation in a large number of cases is necessary for definite conclusion in this eminently chronic group of affections. The results are expected to be of great importance, independent of the therapeutical effect. It will be possible to determine the actual influence of the peripheral circulation in different types of arthritis. The deep alteration of the skin circulation by histamine, if by itself without permanent value, could eventually be used as an adjuvans of a more specific therapy.

Neuralgia.—Out of thirty-two cases of neuralgia, twenty-three were reported improved. Of these, nine only transitory improved. Deutsch had failures in three cases of neuralgia of the nervus cutaneus femoris lateralis and regarded histamine as ineffective in pure neuralgia and improvement as indication that the muscle was chiefly involved, especially in ischialgia.

Acroparesthesia.—Vas reported good results in eighteen cases out of twenty of acroparesthesia of the hands or feet. I have a series of cases under treatment in women of middle age, complaining of numbness, hypersensitivity and paresthesias. To date, I have not seen any marked influence yet, but in these long-standing disturbances the treatment should be continued for a considerable length of time.

Miscellaneous Conditions.—Deutsch had complete failure as to permanent results in ten cases of painful periostitis. Vas claims success in ten cases in furunculosis and in three cases of painful infiltrations after perivascular injections. Of considerable greater interest are his good results in a case of Raynaud's and in two cases of Buerger's disease and in three cases of chronic ulcer of the leg. The action of histamine in these conditions of disturbed peripheral circulation requires extensive investigation.

SUMMARY AND CONCLUSIONS

The application of histamine either by cataphoresis or by the scratch method is presented.

Alteration of the peripheral circulation is the principle underlying the treatment of rheumatic conditions and disturbances of the vasomotor system, by the application of histamine to the affected parts.

The effect of this treatment consists in a dilatation of the minute vessels

and smaller arterioles; in an increase of the blood flow and permeability of the vessels, which causes a hyperæmia and elevation of the skin temperature of several hours' duration. Some evidence is given of a longer duration of the capillary dilatation after considerable treatment. (Bettmann.)

The results in 554 cases collected from the literature are surveyed.

A definite conclusion of the value of this method is at present possible only in myalgia (myositis). Out of 361 cases, 301 were either cured or improved; recurrences were noted in twenty-six cases.

Twenty cases of myalgia of my own observation are analyzed. Of these eighteen were cured or improved, two remained unchanged.

Immediate relief of pain and tenderness after the first treatment is of favorable prognostic significance in this group.

Thorough examination and treatment of all affected muscles and their antagonists are decisive for the success of the treatment.

The material is insufficient in the other conditions to draw definite conclusion.

Secondary myalgia, after trauma, strain and due to static unbalance was benefited in a moderate number of cases.

Three cases of calcified subacromial bursa were successfully treated by me.

A prolonged study in a large series of different types of arthritis is being undertaken, first, to determine the rôle of the alteration of the peripheral circulation; and secondly, to study the eventual therapeutic effect of the histamine by itself or in conjunction with other therapy.

Finally, the effect of the histamine treatment on disturbances of the peripheral circulation (Raynaud, Buerger and arteriosclerotic conditions and acroparesthesia), is under investigation.

NOTE.—I am indebted to Dr. Jerome Weiss, director of the Physiotherapy Department at the Hospital for Joint Diseases for the arrangement of the cataphoresis apparatus, and to Miss Acton for carrying out of the treatments. The patients were derived partly from private practice and partly from the service of Dr. Harry Finkelstein, Hospital for Joint Diseases.

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INDIRECT INGUINAL HERNIA IN THE LIGHT OF THE NEWER INTERPRETATION OF ANATOMY*

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of Philadelphia, Pa.

Doctor Draper, in his Foreword to Doctor Naccarrati's translation of Pende's Constitutional Inadequacies, states:

"There is a peculiar quality of the human mind reminiscent of the rim of a wheel moving slowly onward through deep sand which covers the segment of its circumference. For if one reviews the history of thought in any field of endeavor, the truth of that old saying, 'History repeats itself,' is quite apparent. Yet beyond this, one may perceive

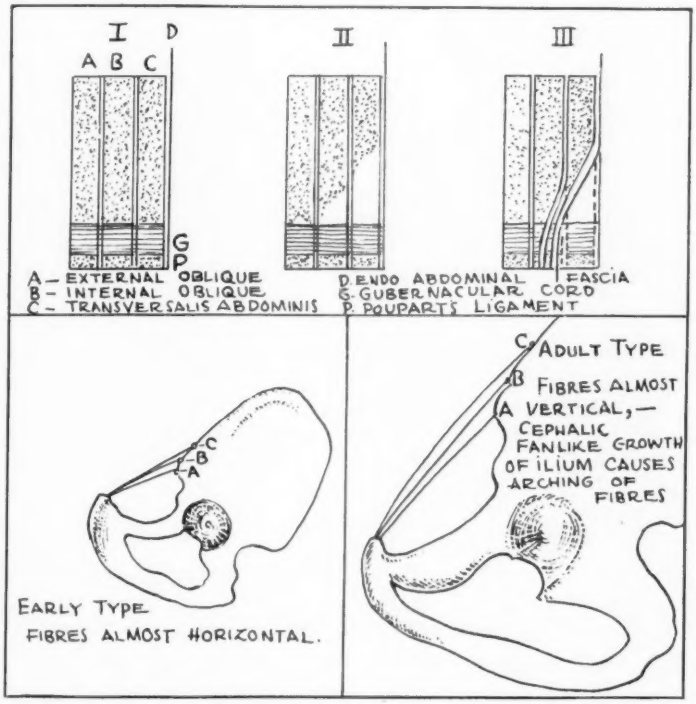

Fig. 1.—Schematic drawing (top) showing embryological development and cephalic recession of muscles of the anterior abdominal wall, the fascial coverings maintaining their attachment to Poupart's ligament. The relative positions of the abdominal muscles in the early and adult stages of development are shown at the bottom.

the striking fact that simple repetition does not fully explain the remarkable growth of man's understanding. As the rising curve of the wheel emerges from the sand and swings upward and forward in the sunshine, the apparent dusty particles of the roadbed are illuminated and cast new light upon the path ahead. Such is the reciprocally energizing effect of ever leaping modern thought and the reposeful quiescence of ancient beliefs."

* Read before the Philadelphia Academy of Surgery, October 2, 1933.

The above excerpt is used as an introduction, because it so aptly expresses the sustained interest in the subject, hernia, especially indirect inguinal hernia.

Hernia is variously described and defined as the protrusion of a viscus, through defects or openings in the structures that ordinarily enclose or confine it. I have no fault to find with this generalized definition, but feel that in reference to the inguinal region the proper perspective has been slighted. It is my belief that the so-called openings, or rather the structures forming

FIG. 2.—The average pattern with the transversalis abdominis arising from the lateral part of Poupart's ligament and the lower border of this muscle closely approximated to the spermatic cord and Poupart's ligament.

the openings, through which the viscus appears, are the primary cause of the hernia, and not the viscus *per se*. Furthermore, these openings cannot be considered as defects or faults in the body, but rather as definite well-planned exits for structures which, through evolutionary changes, Nature has found to be most advantageously maintained outside of the abdominal cavity.

In the development of the average anatomical pattern of the lower ventral abdominal wall, the two primary factors to be considered are:

(1) The development of the undifferentiated abdominal wall-plate.

(2) The development of the gubernacular cord within this abdominal wall-plate.

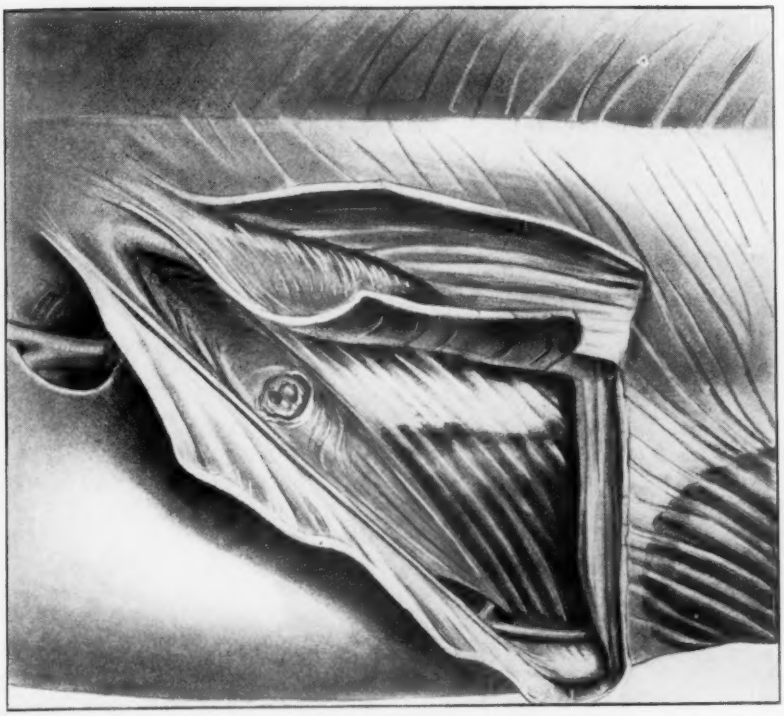

FIG. 3.—Variation in which the transversalis abdominis parallels Poupart's ligament, the lower edge of the muscle forming an arch, but not hugging the spermatic cord.

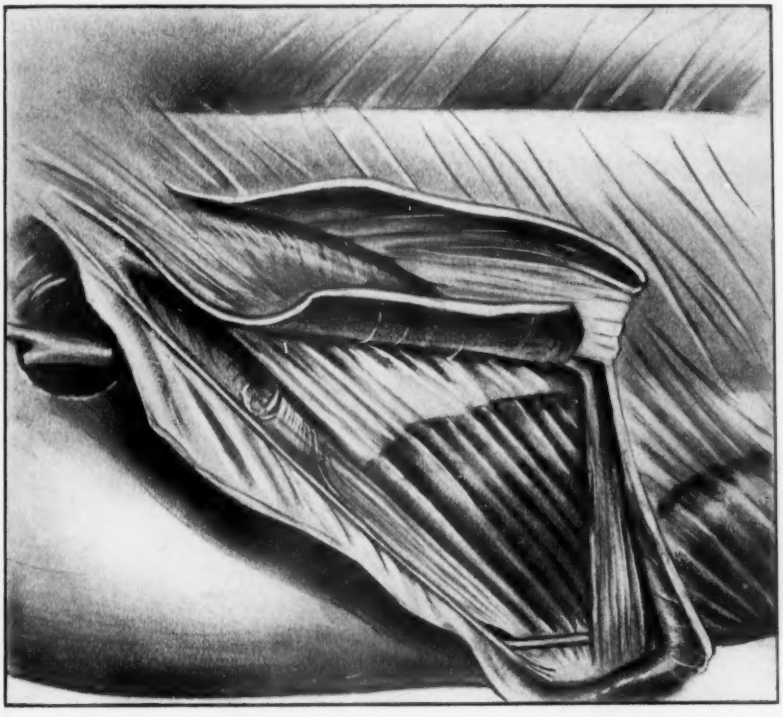

FIG. 4.—Variation showing the lower edge of the transversalis abdominis paralleling Poupart's ligament, no arching of fibres being present.

1. *The Development of the Abdominal Wall.*—The abdominal wall begins as an undifferentiated mesenchymal mass, the anterior abdominal plate, which is lined within by endo-abdominal fascia and peritoneum and without by external body fascia and skin. This undifferentiated muscle plate splits into three parallel, superimposed muscles which extend caudad to the line of Poupart, *i.e.*, from the iliac antero-superior spine to the pubic tubercle. Laterally and above, the plate is attached to the ilium and medially to the pubic bone. In the longitudinal growth of the body the muscle fibres of the internal two muscles, that is, of the transversalis and internal oblique, are pulled cephalad from the Poupart line in a fan-like movement, this process being accomplished by their own growth and by the growth of the ilium. As a result of this cephalic movement, only the fascial coverings of the internal oblique and the transversalis muscles remain. This results in an area of muscular deficiency, the size of which depends upon the amount of recession of the muscle fibres. Thus is formed what is considered by some a defect, but in reality is a point of exit for the testicle.

2. *The Development of the Gubernacular Cord.*—Within the lower or caudal part of the abdominal mesenchymal plate and at right angles to its plane, a special structure is developed which is known as the gubernacular cord. This structure joins the inguinal crest and the testicular ligament on the inside and the scrotal ligament on the outside to become a completed structure—the gubernaculum testis, which then extends from the lower end of the testicular ligament to the skin of the scrotum. In the differentiation of the abdominal plate, the two inner muscles, transversalis and internal oblique, seem to enfold the gubernacular cord while the third or outer external oblique becomes evaginated for its exit. Because the gubernacular cord has no cephalic growth, the testicle is apparently pulled down, in reality guided through the then attenuated fascias and muscle fibres of the transversalis and internal oblique muscles, retaining them as coverings, these coverings collectively being called cremaster body.

When development is completed, the funiculus spermaticus—spermatic cord and appendages—acts as a substitute for the above outline pressure-resisting muscles, in the triangular space bounded by the pubic bone, the ilium, and the Poupart line. To protect this triangular space Nature then employs her contraction mechanism which closes it effectively, provided all essential structures involved adhere to the primary pattern and no variants develop.

Conceiving Nature as continually experimenting (or, as some call the process, evoluting), one naturally comes to the thought that this evoluting process causes changes, that is, variations in the primary pattern. These changes or variations, however slight they may be, will influence the definitive pattern, and, as applying to exits, will govern their size, shape, and tension.

In a comparison of the inguinal canal with the many diverse valvular constructions found in the body, one is impressed with the singleness of pattern or uniform mechanism employed, a fact which has heretofore not been sufficiently taken cognizance of in the literature. The mechanism to which I refer is the oblique projection of the structure to be valved or constricted through two or more layers of muscle, the valve effect or constriction being obtained from the muscle tone or by muscle contraction.

If the oblique projection of structures through two or more muscle planes be the universal scheme of valve construction, one would suppose that Nature would not radically change her method at a site as in the inguinal region where such a valve effect is necessary.

The insertion of the gubernacular cord, *i.e.*, the funiculus growth factor

FIG. 5.—Type of variation in which the arching fibres of the transversalis abdominis reach the middle of the anterior superior spine, the maximum arching being found lateral and cephalic to the cord. In this type of variation even the maximum contraction of the muscle would not cause a closure of the triangular space bounded by the anterior superior spine, pubis and Poupart's ligament.

FIG. 6.—Variation in which the lower fibres of the transversalis arch above the anterior superior spine. The space lateral to the cord is very large, making closure of the space between pubis, Poupart's ligament and the anterior superior spine impossible, even by maximum contraction of the transversalis abdominis.

in the undifferentiated abdominal wall and the subsequent development about it of three parallel muscles, two active and one passive, gives evidence of such a valvular construction. These three muscles by their fan-like insertion, slide action, and contraction, normally close the triangular space bounded by the ilium, pubis, and Poupart line. This valvular construction Connell has called "the keystone of the inguinal arch," and MacGregor, after proving its sphincteric or valvular action, has named it "the inguinal sphincteric ring." MacGregor, Connell, and various other investigators, including myself, attach little importance to the pressure-resisting action of the external oblique muscle, for the reason that the external oblique muscle is never able to substitute as a valve component when the valve action of the transversalis and internal oblique muscle is deficient. Because of its fixation and early canalization, the external oblique muscle plays only a passive rôle in the resistance to intra-abdominal pressure.

While Nature seems to adhere to a single pattern of valvular construction, variations often develop; amid these are widened, narrowed, and attenuated conditions of the transversalis and internal oblique muscles, the depicted variations being due to either excessive pull or recession from the Poupart line. Such modifications produce a greater than ordinary triangular space between the ilium, pubis, and Poupart line and leave the space unprotected to a greater or lesser degree from the intra-abdominal pressure. As a result, the possibility for herniation is considerably enhanced.

Adequate knowledge as regards the potentiality for hernia is of primary importance to medical examiners of industrial employees. All of us have seen individuals with widely dilated external rings who, having been rejected because of believed potential hernia, have disappointed expectations and prophecies by not developing hernia, even after years of heavy lifting. On the other hand, it is well known that individuals with tight external rings who have been approved for employment returned very soon, in fact all too soon, to the medical examiner with well-developed hernias and in doing so caused him great surprise and chagrin.

Much has been said about methods, repairs, and hernial openings and the resultant successes and failures. Why the identical operation in a series of patients gives surgeons a variety of results, that is, no recurrence in a certain percentage, all grades of recurrence and complete failure in still another, still remains a major problem for analysis. Some authors attribute these diverse results to many factors, but few seem to have considered (in the few analyses available on the basic causes of these successes and failures) the individual who needs repair and why he needs repair. Upon the presentation of the individual for repair the thoughts of the surgeons are, as a rule, in terms of inguinal operations as outlined by Bassini, Ferguson, Macey, and Champonier, rather than upon the actual cause of the hernia, that is, failure of support due to evolutionary variations of the muscle components or to general muscle failure.

In view of what I have said on the development of muscles about the

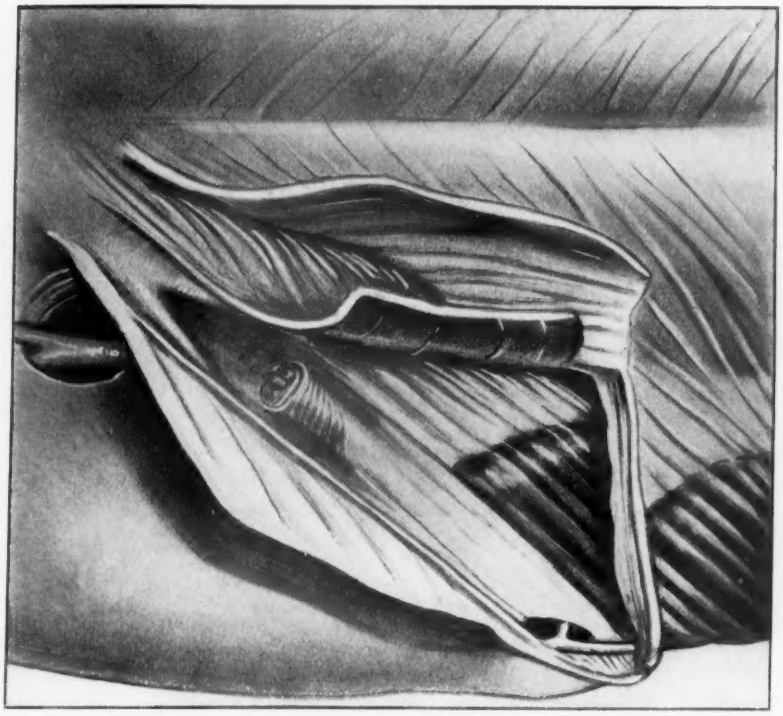

FIG. 7.—Variation showing the tranverse abdominis origin far above the anterior superior spine; closure of the triangular space by a maximum contraction being impossible.

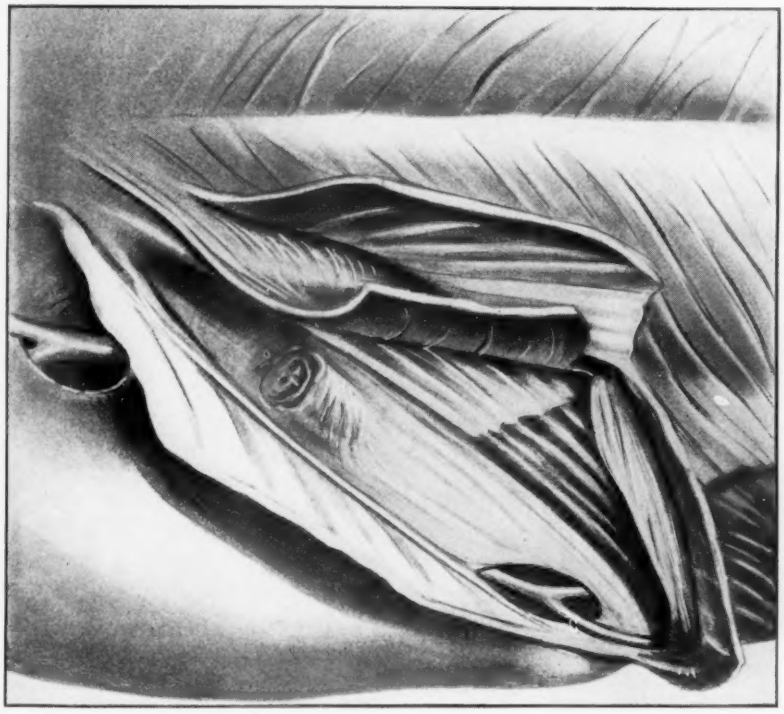

FIG. 8.—Variation showing a cephalic recession at the transversalis abdominis one and one-half inches from Poupart's ligament. The arch of the fibres of the muscle extends into the flank. An approximation of the lower edge of the fibres to the free margin of Poupart's ligament and the cord is not possible.

inguinal canal, our old conception of hernia formation and potentiality should be revised, the newer interpretation comprises the following points:

(1) The universal valve pattern and variations of that pattern as a cause of hernia.

(2) The external ring has no influence in the prevention of viscus exit, and, therefore, should not be given the position of primary importance it now occupies in the examination of employees.

(3) The internal arch formation of the transversalis and internal oblique muscles should be the primary consideration in all examinations since it is the active preventive of viscus exit.

(4) Attention should be focused on the variational rather than upon the average anatomy as a basis for technic.

(5) The surgeon should devise a technic to remedy the structural failure of the individual case rather than adhere to a surgical routine.

The problem I have presented is an anatomical one. The important problem now is to determine whether inguinal hernia, direct or indirect, occurs more frequently in cases in which the space between the ilium, the pubis, and the inguinal ligament is largely unprotected. This has not been done. I am hoping to continue the study with this in mind.

I wish to extend thanks to Dr. J. Parsons Schaeffer, Director of the Daniel Baugh Institute of Anatomy of the Jefferson Medical College, for his interest in this study and for the access to the anatomical material, and also to Dr. N. A. Michels for his helpful suggestions in the preparation of this paper.

CYSTS AND SINUSES OF THE SACROCOCCYGEAL REGION*

By Thomas Herbert Thomason, M.D.

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from the Beall Clinic

The sacrococcygeal region, owing to its very complex embryology, is perhaps the most common site in the body for anomalous cysts, sinuses, and tumors of "developmental origin." "The caudal end of the embryo," says Moersch,[8] "represents a Sargasso sea, producing as a result of its variegated structures a 'histological pot pourri.'" "It is in this area," according to Hundling,[5] "that the caudal termination of the primitive streak should most accurately attain its involution and evolution; the neurenteric canal develop and disappear; the anus complete the intestinal tube, and the inferior extremities symmetrically adapt themselves to the trunk." And in the same neighborhood, the complicated processes of the genito-urinary tract arise.

Tumors resulting from errors in these involved processes are, for the most part, cystic, though rarely a solid tumor is found. They may be present at birth or make their appearance at any time subsequent to it. Sooner or later sinus formation takes place, usually with infection.

These cysts and sinuses may be divided according to their location into two classes, those which lie dorsal to the sacrum and coccyx and those which lie anterior or ventral to these structures. The former are quite common and are not infrequently seen in an ordinary practice. Usually they have been operated on at least once. They are commonly known as pilonidal (hair nest) sinuses or coccygeal fistulæ, occur most often in males, and are apparently peculiar to the white race. Their pathology is relatively simple and their removal may be accomplished without difficulty if done carefully. Stone,[12] in 1924, reviewed this subject and reported forty cases from the Johns Hopkins Hospital and his private practice. An early reference of particular interest is a report of five cases of coccygeal dermoid by E. J. Beall,[1] in 1889.

A much more formidable problem is presented by those cysts and tumors which lie in front of the sacrum and coccyx. They present a more complex and varied pathology. They produce more serious symptoms, and their surgical removal may be a very complicated procedure. Pearse[10] observes "the confusion of the amateur pathologist who attempts their study is only exceeded by the confusion of the amateur operator who attempts their removal." He reports a case of ventral tumor of the sacrum on which he operated three times before finally curing his patient. They have been called Mitteldorpf tumors, the term including a diversity of growths, dermoid cysts, teratomata, carcinomata, chordomata, and ependymal cell gliomata.

* Read before the Texas Surgical Society, February, 1932.

Law[7] has given the name ventral tumors of the sacrum. He reported in 1922 two cases mentioning a total in the literature of thirty cases. Hundling,[6] in a thorough review of the subject in 1924, reports nineteen cases from The Mayo Clinic.

From the above, it would appear that the incidence of this condition is relatively rare. Calbet collected 203 cases of sacral tumors in the newborn, finding them to occur once in every 34,582 births. The rare incidence in adults has been attributed to the fact that most infants so affected fail to survive the first year of life.

A discussion of these lesions would not be complete without a brief review of the embryology of the region in which they occur. To quote Hundling again, "During embryonic life while the entoderm is forming the caudal intestine, the dorsal canal and dorsal cord, the mesoderm, the connective tissue, blood-vessels, vertebræ, and muscles, and the ectoderm is forming the primitive streak, the medullary tube and its vestiges, there is a continuation between the central canal of the spinal cord and the primitive alimentary canal around the caudal extremity of the notochord. This canal, which forms the communication between the cord and the gut, is known as the neurenteric canal. When the proctodæum or primitive anus invaginates to form part of the cloacal chamber it meets the gut some distance anterior to and above the point where the neurenteric canal opens into it; hence, there is for a time a segment of intestine behind the anus termed the postanal gut. This, as well as the neurenteric canal, later becomes obliterated."

While there are numerous and diverse theories as to the origin of sacrococcygeal tumors, it is generally agreed that most of the type considered in this article arise from vestiges of the neurenteric canal and post-anal gut, including the so-called coccygeal vestiges. The relation of the simpler dermoid cysts and sinuses lying behind the coccyx to the neurenteric canal is rather easy to follow. They contain hair and sebaceous material, are lined with epithelium, and may be traced as a rule to the hiatus of the sacrum. Stone[11] suggests that the same anlage which give rise to the "preen gland" of certain birds and to analogous structures of some mammals and reptiles may be persent in certain individuals of the human species, developing for some reason into the structure known clinically as pilonidal sinus.

The more complex ventral tumors of the sacrum probably arise in many instances from the post-anal gut, and this theory is held by such observers as Keen, Bland-Sutton,[2] and Mitteldorpf, who was the first to describe these growths. Mitteldorpf tumors, however, include such a varied and bizarre collection that the question of their origin has not been definitely settled. Many of them, no doubt, arise from "totipotent" cells which have been set aside at an early stage in embryonic life to resume development years later. Others, like teratomata elsewhere, are really "parasitic fetuses" or suppressed twins.

The pathology of pilonidal sinus is simple. From a small orifice—post-anal dimple—it extends backward away from the anus toward the sacral hiatus as an indurated infected tract. It may extend laterally under the skin of the buttock for several inches. The symptoms are those of recurrent abscess formation, usually following an initial trauma, and present little

difficulty in diagnosis. Pilonidal sinus must not be confused, however, with anal fistula, osteomyelitis of the sacrum and coccyx or simple pyogenic abscess.

Ventral tumors of the sacrum tend to grow upward into the hollow of the sacrum eroding the bone, and displacing the pelvic organs anteriorly. They are as a rule definitely encapsulated and may obtain considerable size. Sinus formation with secondary infection forms a constant part of the picture and a history of multiple operations is common. They are prone to undergo malignant degeneration, spreading by extension and invasion rather than by metastasis. The symptoms are constipation, pains in the sacral region and down the thighs, swelling of one or both buttocks, and the presence of a persistent sinus. The last may be the only indication of trouble. Ventral tumors must be differentiated from the more common pelvic growths, as well as the rarer meningocele, myelocele, and spina bifida.

The treatment of pilonidal sinus is careful excision of the sinus tract and cyst wall down to the point at which the rudimentary canal enters the sacral hiatus. We have found the injection of blue dye, such as indigo carmine, very useful in delineating small tracts, though others, I am sure, get as good results with specially prepared paste. Wide excision of the skin about the sinus has been commonly practiced, the wound thus made being expected to granulate and epithelialize after a period of many weeks. A far better procedure, I find, is the excision of only a narrow tongue of skin including the sinus opening, the removal of no more tissue than is necessary, followed by primary closure of the wound, except for a small drain. Cases so treated have in our experience healed promptly by first intent—a distinct improvement over the other method.

Tumors of the ventral sacrum should be treated surgically, their removal being at best a formidable procedure. Attempts at extirpation by the abdominal route uniformly failed on account of excessive hæmorrhage and inaccessibility of the lesion. Law,[7] in 1912, described a method of attack by the posterior route, using the Kraske incision with removal of the coccyx and lower portion of the sacrum. A wide opening can thus be effected and careful excision of all diseased tissue be carried out. Thorough removal is essential, as the growths tend to recur. In the case here reported it was necessary ultimately to modify this approach by incisions laterally into each buttock spreading the fibres of the gluteus maximus. In most cases thorough radiation is recommended as an adjunct to surgery. The prognosis depends on the nature of the tumor. Recurrence is common and the incidence of malignant degeneration is high.

This review of sacrococcygeal tumors was suggested by the following cases:

Case I.—Mrs. E. H., thirty-four, a seamstress, came to the Beall Clinic in August, 1929, complaining of pain and soreness in the sacrococcygeal region, a foul draining sinus posterior to the anus, swelling of the right buttock, fever, and constipation. At six years of age following an attack of scarlet fever she developed an abscess posterior to the

anus which on incision was found to contain hair. Since then she has had many operations, with always a draining sinus. At eighteen, she had a laparotomy, the surgeon noting at the time a rough growth in the anterior sacral region. At twenty-five a surgeon attempted to remove the tumor, excising a very large mass of tissue containing hair. A year later the patient developed another abscess which was drained, following which she wore a tube four inches long until August, 1929, when her symptoms again became intolerable. The past history is not significant, except for the fact that the patient has had three miscarriages. The father and two siblings are living and well. There is a history

FIG. 1.—(Case I.) Röntgenogram of pelvis showing sinus injected with lipiodol.

of death from cancer in the paternal grandfather, both maternal grandparents, mother, two maternal uncles, and one maternal aunt—seven in two generations.

The patient was a well-developed, intelligent woman who was in much pain, looked sick and had a temperature of 101°. There was a draining sinus one inch posterior to the anus, in which the patient kept a rubber tube four inches long. The right buttock was greatly swollen and tender. On pelvic examination, the sinus tract with its tube could be traced to the left and seemed to run into a rounded mass in the hollow of the sacrum. To the right of this mass and connected with it was a hard and very tender mass which felt like chronic inflammatory tissue. Laboratory findings were negative. The sinus was injected with lipiodol and an X-ray made. (Fig. 1.)

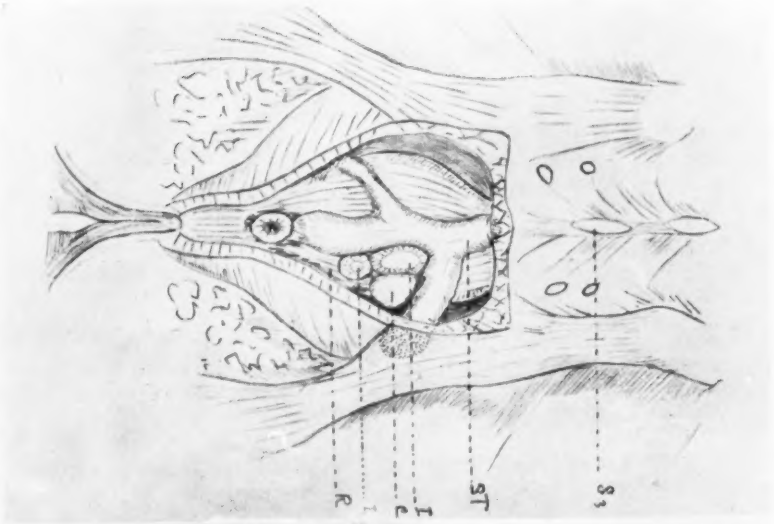

FIG. 2.—Diagram showing extent of sinus tract in Case I. Coccyx and lower sacral segments have been removed.

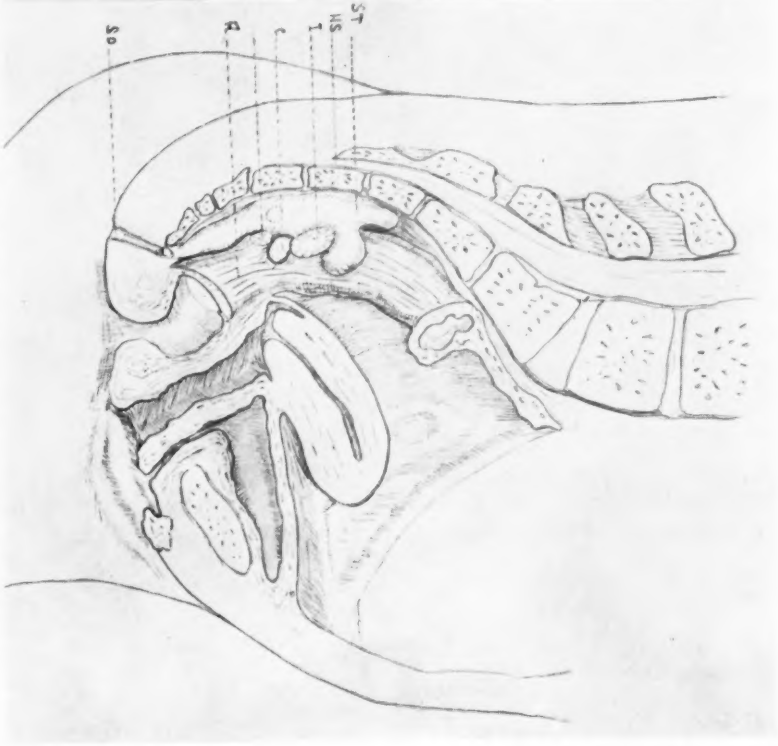

FIG. 3.—(Case I.) Lateral view of sinus tract. Diagrammatic.

Operation.—August 15, 1929, under general anæsthesia, an attempt was made to dissect out the sinus tract. From its opening at the tip of the coccyx, it extended downward to the rectum, then upward and forward between the rectum and sacrum. At the base of the coccyx the y-tract divided, one branch extending to the left under the edge of the gluteus, while the other passed upward close to the sacrum and back downward to the right. The tract contained several ounces of foul soupy mucopus. The coccyx and lower three-fourths inch of the sacrum were removed. It seemed impractical to attempt complete dissection of the tracts, so they were thoroughly carbolized and the wound left open.

Symptoms persisted and November 26, 1929, a second attempt was made. The incision was widely opened and two cysts were dissected from the rectum. One was smooth-walled, containing thick mucoid material, and the other resembled grossly and microscopically a section of small intestine. Radium was left in the depths of the wound and the incision closed.

Symptoms still persisted and February 19, 1930, a last attempt was made to relieve the patient. The incision was laid open as before and in addition, incisions were made

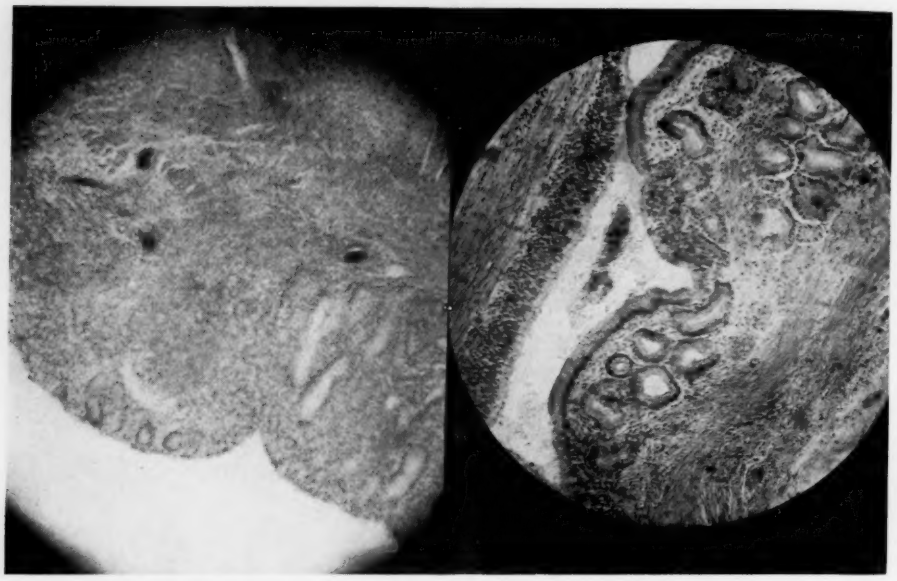

FIG. 4.—Section through wall of sinus tract. Note structures resembling intestinal mucosa and Peyer's patch.

FIG. 5.—(Case I.) Section through wall of sinus. Showing mucous glands.

laterally into each buttock from the upper third of the wound. The rectum was peeled clean posteriorly and the tract dissected out as indicated in the accompanying diagram. (Figs. 2 and 3.) By means of the lateral incisions spreading the fibres of the glutei we were able to obtain much better exposure than on other occasions.

Following the operation the patient recovered rapidly and has had no more drainage. For the first time in twenty-eight years, she is free of a foul sinus which has clouded her entire existence. The lapse of two years finds her in perfect health.

CASE II.—W. R. P., twenty-seven, had a draining sinus just to the right of the coccyx tip which began as a small swelling nine months before. It had been incised twice, once rather deeply, only to recur later. Examination showed a prominent elongated coccyx with a sinus tract opening 2 cm. to the right of its tip and extending anteriorly. At operation this tract, injected with indigo-carmine, was followed inward to its terminus in a cyst-like structure which lay against the muscular wall of the

rectum about one and three-fourths inches from the opening of the sinus. The cyst was lined with a definite smooth membrane. Following its removal, the patient made an uneventful recovery.

CASE III.—H. C. S., twenty-nine, noticed some soreness at the end of his spine after a fall on his back fourteen years ago. In recent years this has gotten worse and in the past few months he has been much inconvenienced by soreness and swelling which extended into the left buttock. Examination showed a definite post-anal dimple, from which an indurated tract extended subcutaneously for three inches into the left buttock. At operation the tract was dissected out, and though it had burrowed laterally for several inches it also extended upward posterior to the coccyx to the hiatus of the sacrum. The wound was closed, except for a small drain, and healed by first intent. The sinus tract contained hair and showed evidence of infection.

Comment.—While growths of the Mitteldorpf group cover a wide range of weird malformations, tumors of the post-anal gut proper seem to have

FIG. 6.—(Case I.) Section of sinus wall. Note mucosa suggesting villi of small intestine.

a rather constant pathological structure. "They are composed of closed vesicles lined with glandular epithelium, sometimes cuboidal and sometimes columnar in type. The cysts are filled with ropy, glue-like mucus and vary in size from four centimetres in diameter to the smallest space visible to the naked eye." The findings in Case I coincide closely with descriptions of typical tumors of the post-anal gut. As a matter of fact, the specimen removed was a post-anal gut. Careful examination reveals that the entire sinus tract, with the exception of the part destroyed by inflammatory change, was composed of intestine with typical longitudinal and circular muscle fibres and a mucosa which contained glands, apparently from various levels of the alimentary canal. (Figs. 4, 5 and 6.) Some of the sections show definite Peyer's patches. The characteristic closed vesicles described by Bland-Sutton[2] and others[3, 4] were observed, containing the typical ropy, glue-like, mucous secretion. No hair was found in any of the tissues removed by us.

The history of its having been removed at previous operations suggests, of course, that our tumor, whatever else it may be, is a teratoma, perhaps, a "suppressed twin."

The cyst in Case II probably originated from the post-anal gut. There were associated anomalies such as the enlarged tail-like coccyx and a non-fusion of the lamina of the first sacral vertebra.

Case III represents a bizarre type of pilonidal sinus. We have operated on a number of these cases in recent years. In one the usual wide excision of skin and tissue was done. His convalescence included many weeks of daily dressings. In five a minimum amount of skin was excised, the tract was carefully dissected out instead of the usual removal *en bloc*, and the wound closed, except for a small drain. All got primary union and were well in less than three weeks. There has been no recurrence in the series. While the idea of tissue conservation and primary closure in these cases is hardly original with me, there is little reference to it in the literature. It is much to be preferred to the usual method of wide excision because it lessens post-operative discomfort, it decreases the period of convalescence, and, lastly, it is neater surgery.

Summary.—Sinus openings in the sacrococcygeal region are usually the external manifestations of cysts or tumors of developmental origin. These cysts are classified with respect to their location behind or in front of the bone into pilonidal sinus and ventral tumors of the sacrum. Rudiments of the neurenteric canal and post-anal gut probably give rise to many of these growths. Sinus formation, infection, and multiple operations is the rule. The diagnosis is not difficult if a careful examination is made, including a digital exploration of the rectum. The treatment of both types is complete surgical removal.

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PERIANAL TUBERCULOSIS*

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It is really only within the past decade that the true relationship between fistula in ano and tuberculosis has been defined, and the problem is still somewhat obscure to many of those to whom it is of most concern—the phthisiologists and surgeons. On the one hand some still feel that most fistulæ are tuberculous and indicate the presence of the disease elsewhere, and others are of the opinion that the surgical treatment of fistula is contra-indicated for the patient with pulmonary tuberculosis. It is with the purpose of combating these misconceptions that I present eighteen proved cases of tuberculous fistula and perianal tuberculosis and combine them with the already recorded experiences of others. Twelve are my own, five were operated upon by Dr. A. V. S. Lambert, and one by Dr. J. A. McCreery.

Pathology and Incidence.—Perianal tuberculosis appears in several forms. The commonest are (1) the perirectal abscess, usually with secondary infection, (2) fistula in ano, and (3) a soft, indolent perianal ulcer. More rarely it may appear as (4) a lupus, (5) a subcutaneous or submucous nodular lesion, (6) an unusual hyperplastic type simulating neoplasm. Tuberculous ulceration of the rectum itself is rare. The tubercle bacillus in the intestinal contents gains entrance to the perianal tissues by the usual paths of infection in fistula and abscess formation: through a diseased crypt, with fissures or local abrasions or irritations, with hæmorrhoids, or from foreign bodies. It is conceivable that it may arrive here also by the hæmatogenous route in a small number of cases, particularly if any of the above conditions are present. If an abscess is formed, it may appear as the typical ischiorectal variety with secondary infection, or it may remain for a time as a non-tender swelling with induration of the subcutaneous tissues near the mucous margin. Eventually this becomes secondarily infected or softens and breaks and then persists as an indolent swelling with profuse thin purulent or watery discharge, and the edges of the opening heaped up with pale unhealthy granulations. The same description holds true when one of these secondarily infected abscesses has been inadequately opened after the pyogenic infection has begun to subside.

When a fistula is present the external opening is large with purplish, overhanging edges and there is a copious, thin, creamy discharge. As in the non-tuberculous fistulæ there may be multiple external openings with extensive spread of the infection to the surrounding tissues of the ischiorectal fossæ and perineum and eventually even to the buttocks themselves. There is usually only one internal opening and this is generally superficial or between the sphincters. Occasionally, just as with the non-tuberculous fistulæ, there are

* Read before the New York Surgical Society, October 11, 1933.

two or more internal openings; this occurred but once in the eighteen cases here reported. A fistula may complicate or be complicated by a perirectal abscess; in the former instance it may be of the blind external variety due to inadequate drainage of the original abscess.

The third common form of perianal tuberculosis is the ulcerative type. Here a soft, shallow ulcer appears at the mucocutaneous junction. The ulcer is characteristically tuberculous with a sluggish gray base and overhanging bluish edges. It spreads slowly either up into the anal canal or out into the subcutaneous tissues of the perineum and ischiorectal fossæ. As a rule it appears at the site of some preëxisting lesion such as a fissure or hæmorrhoids. Two examples of this are included in my series: the first followed an operation for hæmorrhoids in the presence of an active pulmonary lesion with positive sputum; the second complicated a small fissure and was the presenting symptom of an active, incipient tuberculosis of the lungs.

One example of the nodular type is reported here. This appeared during convalescence following excision of a fistula. Successive soft and only slightly painful nodules appeared in the perineum and subcutaneous tissue of the ischiorectal fossæ. If left to themselves the overlying skin became gradually discolored and thin and finally broke. Simple excision resulted in prompt healing.

Diagnosis and Incidence.—Inasmuch as fistula and abscess comprise at least 85 to 90 per cent. of these perianal lesions, the chief problems of comparative frequency and accurate diagnosis occur in those groups.

TABLE I

Fistula in Ano

	No. Cases	Per Cent. Tuberculosis
Allingham	1632	14.
Pennington	701	14.
Fansler	204	2.5
Melchior	132	61.
Mayer	139	9.5
Frey	72	6.9
Elting	105	8.6
Dudley	72	1.4
Gabriel	72	20.
Stone	31	10.
Personal	102	25.5
Buie	1000	5.4
Gaston and Hogan[6]	108	12.9
Chisholm	106	12.9
Gant		10.
Thoss		5.5
Hartmann	200	50.
Berry (Presbyterian Hospital)	160	10.6
Berry (Bellevue Hospital)	202	18.3

Above table taken from Tung,[15] with series by Buie, Gaston and Hogan, Chisholm, Hartmann and the author added.

Table I gives the number of cases of fistula reported by various authors within the past twelve years and the percentage recorded as tuberculous. This latter shows the astonishing discrepancy between a minimum of 1.4 per cent. tuberculous fistulæ in a series reported by Dudley and a maximum of 61 per cent. in Melchior's 132 cases. Three reasons for this variation are immediately suggested. First, there would naturally be a difference between a group of cases selected from a general hospital service and one from a tuberculosis sanatorium or a hospital with an attached tuberculosis service or affiliation. Secondly, many fistulæ are operated upon, either by incision or excision without any subsequent tissue or bacteriological examination. Furthermore, tuberculosis, even when present, is frequently missed in that too few sections are studied. Thirdly, there is a variation in the methods used for diagnosis. Some authors insist that the diagnosis must be proved by the presence of tubercle bacilli in the discharge, histological evidence, or guinea-pig inoculation. Of these, the last is the most reliable although all are open to error; thus Gabriel's figure of 20 per cent. is based on positive guinea-pig inoculations. Others are not as rigid but base their figures on the clinical appearance of the abscess or fistula even with negative histological findings. Tissue for microscopical examination should be carefully selected and even then there may be so much simple acute and chronic inflammatory reaction present that the underlying tuberculosis may be missed. Buie[1, 2] states that of his thousand cases, although fifty-four were clinically tuberculous, yet this could be proved histologically only in twenty-two. Out of all this but one fact stands out clearly: fistula in ano is not usually tuberculous, as was formerly thought; on the contrary, tuberculosis is present only in a small percentage of fistulæ, probably not over 10 per cent.

There is, nevertheless, a causal relationship between fistula in ano and pulmonary tuberculosis. Of 9,840 admissions in one year to two large general hospitals, fistula was present in only 0.6 per cent.

TABLE II

Cases of Pulmonary Tuberculosis with Fistula in Ano

	Cases Pulm. Tbc.	Per Cent. Fistula
Leslie[9]	3452	2.2
Walsham	891	.8
Buie	9568	2.73
Buie (Trudeau)	4160	1. plus
Smith		1.–30.
Hartmann		4–5.
Martin		7.

Table II, on the other hand, states the percentage of fistulæ as found in patients in various tuberculosis sanatoria and hospitals and demonstrates a consistent and definitely increased incidence. Again opinions differ as to the percentage of tuberculous fistulæ in patients with phthisis. Fansler[5] states that 15 per cent. of these fistulæ are tuberculous, Leslie[9] says that they are nearly all positive in patients with active phthisis, Smith[14] gives 4 to 10 per

cent. as tuberculous, and Clark says that 20 per cent. can be proved by guinea-pig inoculation. Chisholm[3, 4] reports a series of thirty-one active pulmonary cases operated upon of which twenty-four (77 per cent.) were proved positive for tuberculosis; of eighteen inactive cases only ten (55 per cent.) were positive. In a recent article Martin[11] thinks that more than 72 per cent. of fistulæ in patients with pulmonary tuberculosis are tuberculous. Seven per cent. of all pulmonary tuberculosis cases in the Municipal Tuberculosis Sanatorium in Chicago presented anal fistulæ. As is expected, therefore, it is evident that the incidence of tuberculosis in fistula in ano in patients with active pulmonary lesions is definitely increased.

There is, furthermore, general agreement that tuberculosis is rarely if ever primary in fistula; in more than 98 per cent. of the cases the original focus is elsewhere. It may, however, be the initial sign of the disease, which should always be suspected with the appearance of a fistula in an underweight individual.

Treatment.—The only proper treatment of perianal tuberculosis and fistulæ is complete excision whenever possible. Secondarily, infected ischiorectal abscesses should be widely drained and then later the remaining tract excised should one persist. 'The removal of this suppurative focus benefits the patient. . . . Toxæmia is reduced and the patient is made more comfortable. . . . Fistulectomy carries out one of the cardinal tenets of present-day therapy . . . *i.e.*, elimination of tuberculous or non-tuberculous complications to focus healing ability on the pulmonary lesion." (Martin.[11]) There is still a widespread feeling against surgery, however. Within the last year the head of a well-known tuberculosis sanatorium advised against operation for fistula in ano in one of his patients on the ground that no cure could be accomplished, rather the condition might be aggravated. Similarly it was the opinion of the surgeons of one of the services in a large general hospital that a tuberculous patient referred to them with multiple fistulous openings in both ischiorectal fossæ should not be operated upon because tuberculous fistulæ do not heal. Both of these patients were operated upon by me with resulting cures. One developed several subcutaneous tuberculides in the course of his convalescence, all of which were successfully excised; the other was operated upon in two stages and healed promptly.

Chisholm,[4] in 1928, sent a questionnaire to a number of physicians in Colorado as to their opinion of operation for tuberculous fistula. His questions and replies were:

Do you recommend operation? Yes, 2. No. 22. Selected cases, 4.
Apparent end-results? Unfavorable, 24. Favorable, 41.
Anæsthesia employed? General, 28. Local, 0.
Technic? Knife, 28. Cautery, 0.

He uses the cautery as he thinks the knife opens up new channels for infection and spread and also the cautery prevents the growth of the tubercle bacilli. He reported a series of twenty-two cases of complete or multiple tuberculous fistulæ all cured following cautery excision under sacral or caudal anæsthesia.

The usual objections to the surgical treatment of fistulæ are that (1) operation may cause general dissemination of the disease. This is not so and hence is a needless fear.

(2) Operation is said to diminish the resistance of the tuberculous patient. Again this is not true. On the contrary, patients are frequently greatly benefited. In the case of E. U., the temperature, which had been up to 100 to 101° daily, promptly subsided, the wounds healed after two further minor excisions, and now, seven months after his operation, he is working as an automobile salesman.

(3) Another objection is that the fistula can not be cured by operation and is merely converted into an ulcer. Again this is contrary to fact if the operation has been properly performed and the dressings carefully supervised. This may occur at times due to too prompt closure of the skin with the persistence of a shallow undermining ulcer in the lower anal canal. It has occurred twice in my series: once the ulcer was reëxcised and curetted with a good result. The second case is now under treatment following a similar procedure. Both were ward cases and I feel that both could have been avoided by more painstaking dressings.

Hartmann,[8] in controverting these objections, states that he has operated successfully upon 584 cases of tuberculous fistula in ano. Martin reports seventy-five cases with 87 per cent. cures.

TABLE III

Author's Series

	Sex	Pulm. Tbc.	Rectal Lesion	Result
K. L.	Female	Arrested	Fistula	Cured
J. E.	Male	Quiescent	Fistula	Cured
J. B.	Female	Active	Ulcer	Cured
I. C.	Female	Arrested	Fistula	Cured
J. K.	Male	Active	Abscess	Cured
H. S.	Male	Active	Fistula	Cured
H. P.	Male	Arrested	Fistula	Cured
J. F.	Male	Arrested	Fistula	Cured
H. R.	Male	Arrested	Fistula	Cured
R. E.	Male	Arrested	Fistula, Nodular	Cured
E. U.	Male	Quiescent	Fistula	Cured
J. H.	Male	Arrested	Fistula	Cured
F. I.	Male	Active	Fistula	Cured
E. H.	Male	Active	Fistula	?
V. N.	Male	Active	Ulcer	Cured
W. K.	Male	Active	Abscess	Improved
A. B.	Male	Active	Fistula	Unimproved
W. B.	Male	Active	Fistula	Improved

For all operations in the perianal and perineal regions in tuberculous patients, whether active or quiescent, I believe that a low spinal anæsthesia is the best form of anæsthetic. It is safe, easy to administer, gives perfect anæsthesia with complete relaxation of the sphincter, and yet offers the minimum of disturbance to the respiratory tract. A 50 or 100 milligrams dose of novocaine (procaine) crystals is used; these are dissolved in 1 to 2 cubic centimetres of spinal fluid. As the puncture is begun, 50 milligrams of

ephedrine are given subcutaneously. If, for any reason, spinal anæsthesia is not possible I should prefer avertin or sodium amytal and ethylene, or else chloroform. With abscess I have practised wide incision and evacuation, wiping out the cavity with 95 per cent. phenol, and packing with iodoform gauze for three or four days. Following this 95 per cent. phenol is used to paint the walls of the cavity every five or six days and dry dressings applied. Further packing is required only if there is a tendency for the mouth of the wound to heal too soon and then it is inserted very loosely only occasionally. Absolute cleanliness is of course essential and sitz-baths are very helpful.

For the excision of ulcers or fistulæ the patient should be thoroughly prepared beforehand. He is given a cathartic preferably two days before operation, and a cleansing enema on the intervening day and also on the day of operation two to four hours before going to the operating room. This provides a clean field and prepares the intestinal tract for a period of post-operative constipation. An ulcer is completely excised with the cautery, endothermic knife, or scalpel. So far I have used only the last-named. The wound is then treated with 95 per cent. phenol and packed with iodoform gauze for three or four days until granulations form; then the further treatment is the same as that already outlined. If the ulceration is extensive, it may be wise to perform the operation in two stages.

In dealing with fistulæ a careful study should be made of them and their various openings, both external and internal, and a plan of operation formulated. The fistulæ should be *carefully* probed or a dye or bismuth paste injected. If there is more than one internal opening, the operation should be carried out as two or more separate procedures. This applies also if there is only one internal opening but several external with extensive involvement of soft parts. With the exception of the pararectal variety of fistula, which, fortunately, is extremely uncommon as a tuberculous lesion, the entire fistulous tracks and their ramifications in the perineum or buttocks must be excised. Inasmuch as most fistulæ originate in diseased crypts, this can be easily done. The only exception is that if the disease involves the sphincter muscles to any extent some diseased tissue must perforce be left here. As the wound heals, it may be possible to remove this at a later date if necessary. When more than one operation is indicated, as for multiple lesions, each procedure should be thorough within the limits of the field of operation for that stage. Ninety-five per cent. phenol may or may not be used, and the wound is left open and packed with iodoform gauze for three to five days. This insures healthy granulations and resistance to reinfection. Following the removal of the packing the patient is given daily sitz-baths and instructed in keeping the wound as clean and dry as possible. Further very light packing may be necessary occasionally. Ninety-five per cent. phenol is used every five or six days and at these times the finger should be inserted into the rectum to break up false healing and assure proper granulation from the depths of the wound outward. The bowels are usually opened on the fifth to seventh day by an oil enema and mineral oil and milk of magnesia or licorice powder. Complete healing will vary from a few weeks to several months. I have had little ex-

perience with the use of the actinic or ultra-violet rays or natural sunlight during convalescence, though I believe they should prove most helpful.

One of my cases resulted in incontinence of the sphincter. He had a far advanced active pulmonary lesion but was having so much pain and discharge that operation seemed indicated. His resulting incontinence was due to too great enthusiasm on my part in trying to correct a large horseshoe fistula with extensive involvement of the sphincters all at once. This result could have been avoided by planning two operations instead of one. Of the others, four are still under treatment and progressing favorably, and the rest are cured.

SUMMARY AND CONCLUSIONS

Various types of perianal tuberculous lesions have been described.

The proper treatment for these conditions, except the very rare already healed variety, is excision.

Fistula in ano is not as frequently tuberculous as has been commonly supposed. Most are due to simple pyogenic infection. Probably not over 5 to 10 per cent. are tuberculous.

There is, however, a causal relationship between fistula and tuberculosis in that the incidence of fistulæ is higher in tuberculosis sanatoria than in general hospitals.

Not all fistulæ even in tuberculous patients are themselves tuberculous, particularly if the pulmonary lesion is quiescent. In active pulmonary cases probably 75 per cent. or more fistulæ are likewise tuberculous. In the arrested cases probably only 15 to 20 per cent. of the fistulæ are tuberculous.

Tuberculosis is rarely, if ever, primary in a perianal lesion; the original focus should always be sought elsewhere in the body.

Eighteen cases of perianal tuberculosis are reported. All were treated surgically by excision with thirteen (72 per cent.) resulting cures. Five of these patients had active pulmonary lesions. Four others are improved and still under treatment; one is almost entirely healed. There has been one complete failure in a patient with an associated advanced bilateral pulmonary lesion.

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INTERNAL HÆMORRHOIDS: COMPARATIVE VALUE OF TREATMENT BY OPERATIVE AND BY INJECTION METHODS

A Survey of 62,910 Cases

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What is the comparative value of operative methods and injection methods in the treatment of internal hæmorrhoids? This problem has far-reaching importance, both because it is raised frequently and because there is lack of agreement as to the answer. Routine health examinations show how frequently it is raised. The United States Public Health Service[1] found hæmorrhoids in 10 per cent. of 10,000 supposedly healthy male workers. Forty-two life insurance companies found hæmorrhoids in 13 per cent. of 100,000 applicants. If to those who have such trouble we add those who have had it and have recovered, the total would show one in every six adult Americans with a history of hæmorrhoids, and probably 20,000,000 persons in our population will be at one time or another concerned with the answer.

Lack of agreement as to the answer is common knowledge; but this lack of agreement is due to insufficient data and not to lack of experience. We have been using both methods long enough so that we ought to know what they can do. Operative methods are at least as old as Hippocrates, who (400 B.C.), practiced transfixion and ligation of the hæmorrhoids of the citizens of Athens.[2] In the days of Tiberius Cæsar, Celsus[3] at Rome added excision to ligation, and his detailed description of technic still makes excellent reading in operative surgery. Later but still almost a thousand years ago, the Arab physician, Abulkasim (Albucasis[4]) in Spain introduced cautery removal. Although medical diathermy was introduced for rectal treatment in France by Professor Doumer of Lille in 1897,[5] Durand Boisleard of Paris is said to have first used surgical high frequency for hæmorrhoids in 1924.[6]

Less venerable, but old enough, are the injection methods. Injection of chemicals into hæmorrhoids for their cure was first practiced by Mr. Morgan, surgeon to Mercer's Hospital, Dublin, using iron persulphate in 1869.[7] Phenol solutions were popularized by the itinerant irregular Mitchell in Illinois in 1871.[8] Mitchell and his followers used 50 per cent. phenol solutions with the deliberate purpose of making the hæmorrhoids slough out. Nowadays weak solutions of 5 per cent. phenol in vegetable oil or glycerine are used with intent to avoid sloughing and to cure the hæmorrhoids by causing sclerosis of the venous sinuses by interstitial inflammatory reaction. In 1913, E. H. Terrell,[9] of Richmond, Va., introduced 5 per cent. quinine urea hydrochloride. In Berlin, in 1917, Boas[10] began using alcohol. Seventy per cent. alcohol is used by both Boas and Elsner in Berlin and by Bonheim in Hamburg. Delater and Vendel,[11] of Paris, in order to avoid small sloughs following the

use of quinine urea hydrochloride, have recently introduced quinine and urea chlorhydrolactate in 5 per cent. glycerine, which is a less acid salt than quinine and urea hydrochloride and is less likely to cause sloughs.

Arguments in Favor of Operation.—Advocates of operation argue: Operative methods are performed under aseptic conditions and allow a perfect control of the amount of tissue removed. They allow the removal or drainage of other diseased conditions which commonly occur with the hæmorrhoids, notably infected crypts. They allow the removal of venous dilatations under the skin border which later cause thrombotic piles. Operations do not cause sloughs, oily tumors, and rectal stricture. Operation is immediate and avoids many treatments lasting sometimes for weeks or months. Operative results are permanent whereas favorable results from injection treatment are frequently followed by recurrence of the hæmorrhoids.

Arguments in Favor of Injection.—Advocates of injection treatment argue: Injection solutions cannot introduce infection[12] because they are powerfully bactericidal solutions[13]—indeed, an anal canal with chronic infection shows prompt improvement after injections started well above the hæmorrhoids. Injections avoid rectal stricture[14] because they are made underneath the mucosa without stripping off, burning, or puckering up the mucosa. When rectal strictures followed injection treatment they were due either to sloughs or to oily tumors. Sloughs were due to the use of antiquated, strong caustic concentrations of phenol. Oily tumors were due to the use of that abomination, the paraffin derivative, mineral oil.[15] Injection treatments avoid all the post-operative pain that follows many operative procedures. Injection treatments avoid hospitalization. They involve the patient in one-fourth of the expense of an operation. They do not interfere with his regular occupation, and give him what he wants. Recurrences are due to insufficient treatment, and when they do occur, it is a simple matter to give a few more injections.

Method of Survey.—Argument cannot go much farther in settling this problem. It should be taken out of the field of barren controversy and into the field where it belongs, the field of clinical research. A searching study of results from both operative and injection methods to determine the bare objective facts ought to free us from possible subservience to idols of the forum upraised by the partisans of both sides.

There were two possible methods of study. One would make an inquisition into all unfortunate results of hæmorrhoid treatment throughout the country. Such a method would gain but little. For example, if we should suppose, hypothetically, that in one city, five cases of hæmorrhage had been reported following operation or injection, we should have no idea whether the five cases by either method resulted from fifty cases so treated, or whether they resulted from 50,000 cases, as a legitimate risk. It would be impossible to determine by such a method the original conditions necessitating treatment, the technic used, or how far the rules of the game had been played.[16]

The second method of inquiry which I have chosen is to study the results

of both methods at their best, with a control and knowledge of the original clinical conditions. The facts which follow are the result of a questionnaire addressed to 293 proctologists in America, Great Britain, France and Germany. On the suggestion of Curtice Rosser, the American proctologists were taken from a list of members of the American Proctological Society together with men who, though not members, are included in its list of approved proctologists. Through the kindness of Mr. St. George B. D. Gray, of Hove, England, a list of members of the Subsection on Proctology of the Royal Society of Medicine was used. Six French and three German proctologists were included.[17]

Of the many replies received, fifty-seven replies gave definite information. Of these nearly all, *i.e.,* forty-nine, came from the American list of proctologists. It was agreed that the names of the individual contributors should not be mentioned in the final report so that each clinician might feel free to write with utter frankness about his own bad results.

Contemporary Practice.—Nearly all of the correspondents, forty-nine out of the fifty-seven, gave statistics on their personal use of both operative and injection methods, thus indicating that they had had an honest desire to try out both methods without prejudice.

The total number of cases reported as treated by the two methods is: By operation, 36,648; by injection, 26,262.

Method of Choice.—In reply to the question, "What is your method of choice?" answers were:[17] Now use operation exclusively, 11; prefer operation but also use injections, 12; use both methods very extensively or choice depends upon the type of case, 18; injection is the method of choice, 16; total, 57.

Operative Methods.—The methods of operative removal were: ligature and excision, 25,198 cases; clamp and suture, 2,570 cases; cautery, 5,779 cases; high frequency, 101 cases.

Injection Solutions.—The solutions used for injection according to the number of proctologists using each are: Quinine urea hydrochloride (usually 5 per cent.), 23; phenol in oil (usually 5 per cent.), 11; both quinine urea H-Cl and at other times phenol in oil, 8; phenol in glycerine, 3; alcohol 70 per cent., 3; alcohol ergot and phenol, 1; double chlorhydrolactate of quinine and urea in glycerine 5 per cent., 1.

Types of Hæmorrhoids Injected.—Should the third-degree hæmorrhoid, *i.e.,* the hæmorrhoid which prolapses and is not reduced spontaneously, be treated by injection above it? Twenty-six proctologists treat such hæmorrhoids by injection at least in some cases; twenty-two will not treat such cases by injection.

Site of Injection.—Twelve inject above the hæmorrhoid, five inject at its upper border, fifteen inject into the hæmorrhoid and four both above and into the hæmorrhoid.

The above information as to contemporary practice is mentioned in order to make more intelligible what follows as to the results of treatment. It is

not offered as a guide to procedure—the best procedure can, of course, be learned only as we break away from custom and opinion and study the facts as to results. These facts follow.

Comparative Results by Operation and by Injection Methods.—Statements regarding operation will refer to ordinary operative methods, exclusive of high frequency. The results from high frequency will be stated in a separate section.

Mortalities.—In the 33,648 cases treated by ordinary operative methods there were no more than eleven mortalities.

In the 26,262 cases treated by injection there were no mortalities that could in any way be attributed to the injection treatments.

Sloughs following Injection.—One proctologist, whose experience in injection methods was limited to fifty-seven cases, tried various solutions and reports sloughs following injection in every one of the fifty-seven cases. In 26,205 patients treated by forty-two other men there were 228 sloughs of importance. This makes a total of 285 more or less serious sloughs in 26,262 cases, or an incidence of about 1.09 per cent. How serious these sloughs were may be judged from the results as to hæmorrhage and stricture which follow.

Hæmorrhage.—After operations on 31,950 patients there was serious post-operative hæmorrhage in 183 patients or 0.573 per cent.

After injections used on 26,183 patients there was serious hæmorrhage in seventy-three patients. Of these, twenty-eight were in the practice of the doctor who had sloughs in every one of his fifty-seven cases. Including these we have in the whole series a percentage of serious hæmorrhage after injection of 0.279 per cent.

Stricture.—After ordinary operations stricture followed in sixty-eight cases out of 30,925, or in 0.22 per cent.

Stricture after injection methods occurred in six cases out of 26,183, or 0.02 per cent. Five of the six post-injection strictures occurred in the practice of the proctologist who reported sloughs in every case injected. The other case of stricture followed the use of quinine and urea hydrochloride.

Recurrences.—Reports were given on recurrences at the end of three years. These reports are the least reliable part of the answers; indeed, the replies frequently stated that they were merely rough estimates. Out of 29,425 cases treated by hæmorrhoidectomy, the operators estimated that there were 148 recurrences, or about 0.5 per cent.

Out of a total of 9,691 patients treated by injection, the clinicians estimated that there were recurrences in 966, or approximately 10 per cent. Out of a total of 1,915 patients treated by injection in which replies indicated that careful work had been done in the follow-up, there were recurrences in 290, or in 15.14 per cent.

High Frequency.—In considering the 3,110 cases treated by high frequency it should be understood that only 110 of these cases were reported by American proctologists. The other 3,000 were all treated by one French

surgeon. In these cases there was one death which followed but which was not attributed to the high-frequency surgery. Slight bleeding insufficient to require any medical attention occurred in 15 to 20 per cent. of the cases. Serious hæmorrhage occurred in 4 cases or 0.13 per cent. There were no strictures following the high-frequency treatment. Out of 3,000 cases followed for three years there were recurrences in 3 or 4 per cent. and these recurrences were easily cured by two or three secondary treatments.

Comparative Results after Various Injection Solutions.—Phenol in Olive or Almond Oil.—One correspondent volunteered the information that he had seen oily tumors and strictures which followed oil injections by other men, but gave no information as to whether they followed paraffin or vegetable oils nor as to the time following the injection that the oily tumor persisted. On the other hand, another very conservative proctologist with an experience so large as to have covered 5,000 hæmorrhoidectomies in his own practice, volunteered: "I have found no tumors as described by Rosser due to the injection of oil, although I am in accord with his findings."

Eleven proctologists who use phenol in oil exclusively and eight who use both phenol in oil and quinine urea hydrochloride reported no case of rectal stricture following injection of phenol in vegetable oil. Four men who use 5 per cent. phenol in oil exclusively in 2,067 cases report not a single serious slough, no strictures and one hæmorrhage.

Quinine Urea Hydrochloride.—Thirteen men who used quinine urea hydrochloride exclusively in 8,282 cases had twenty-three sloughs, seven serious hæmorrhages and one stricture. If we consider separately the extraordinary report of one correspondent that he had made 5,000 injections of quinine urea hydrochloride without a serious slough, the report by the other twelve proctologists on 3,282 cases is twenty-three sloughs, five serious hæmorrhages and one stricture.

Quinine Urea Chlorhydrolactate.—The advocate of this solution, mentioned above, report that by using it and by practicing finger massage after injection, they have reduced the incidence of small sloughs from 10 to 15 per cent. after quinine urea hydrochloride to less than 1 per cent. with the chlorhydrolactate.

Their formula is:

Double chlorhydrolactate of quinine and urea	5
Glycerine	5
Water	100

Alcohol 70 Per Cent.—The German proctologists in more than 240 cases treated with Bier's hyperæmia and then injected with 70 per cent. alcohol, had no sloughs, no hæmorrhages and no strictures.

Author's View.—It may be of value in deciding as to how far personal bias on my part as collator of this material might unwittingly have influenced handling of the reports, if I state my own viewpoint frankly. I use both operative methods and injection methods and decide between them after ex-

amination and after talking with the patient. Factors guiding the decision are the presence of other associated rectal diseases, the degree of hæmorrhoidal development, the age and general condition of the patient and at times the preference of the patient. Since I have found an operative procedure which prevents post-operative pain and hastens healing I have been using operation in more of the border-line cases.

Operation followed by Prolonged Local Anæsthesia.—Sphincter and levator spasm associated with post-operative pain cause ischæmia in the site of the wound and delay in healing. Those who have injected a prolonged anæsthetic under an anal fissure know how relaxation of the spasm of the sphincter may allow rapid healing of the fissure. A situation similar to anal fissure occurs when an operative wound is carried across the mucocutaneous line. The problems of the newer drugs which cause prolonged local anæsthesia are beyond the limits of this paper, but I will mention that if such prolonged local anæsthesia is used, the anæsthetic need not be injected into the sphincter—it is necessary only that it be injected at the close of the operation in small amounts superficially under the wound chiefly where it crosses the mucocutaneous line. This measure, if added to well-chosen operative technic, should make the patient entirely free from pain for at least three days.

If the eucupin combination of de Takats[18] is used, I advise that the eucupin hydrochloride commonly sold as "eucupin" should be avoided as it is too acid and lacks sufficient margin of safety from sloughing. The eucupin base (Merck) dissolved by adding dilute hypdrochloric acid drop by drop to dissolve one part of eucupin base in one thousand parts of distilled water is more nearly safe.

If nupercaine is used it should not be boiled. I have found by animal experimentation that the statement of the manufacturers that it can be freely boiled without increasing the toxicity is untrue. There has been something wrong with some of the nupercaine solutions used which caused accidents. When I have used nupercaine solution even in the small amounts needed after hæmorrhoidectomy I have made it a rule not to use it until I have injected part of the sample intravenously in a rabbit in a sublethal dose.

Injection Methods.—I have had small superficial sloughs following the use of quinine and urea hydrochloride 5 per cent. into hæmorrhoids, which, while not of sufficient extent to be known to the patient, were annoying to me, and I now use better solutions which are more efficient and cause no sloughs. I have a low opinion of many of the solutions now commonly in use, which have too often been used on human subjects with no adequate preliminary experimental work until the recent valuable studies of Doctor Rosser. Safer and more efficient solutions should appear in the future.

High Frequency.—Electrocoagulation followed by electrodesiccation is hæmostatic and causes less post-operative pain than the scalpel. The great objection to it is the difficulty in determining just how far the current is destroying tissue. I know of a case in the practice of another surgeon in which enthusiastic use of the high frequency caused extensive sloughing of

In the April issue of the ANNALS OF SURGERY attention is called to page 605 of his statement that "nupercaine should not be boiled without increasing its toxicity." The freely boiling of the nupercaine is correct.

the anal canal with a dreadful result. High frequency if used at all should be used as the French use it, in small amounts at a time. In cases where operative removal in the hospital could not be arranged, and where injection methods were not likely to be effective because the hæmorrhoids were partly fibrosed, I have used it in the office with gratifying results; but inasmuch as the amount of tissue destruction is difficult to calculate, I urge that not more than one hæmorrhoid be treated at one time, and that even so, less treatment be given to the hæmorrhoid at one time than will probably be ultimately needed.

SUMMARY AND CONCLUSIONS

Arguments for operative removal of hæmorrhoids and arguments for injection treatment have been stated. A survey was made of cases treated by fifty-seven proctologists who, with the exception of a few foreign clinicians, were all members of the American Proctological Society or on its list of approved proctologists. This survey shows that in 36,648 cases treated by operation there were eleven mortalities and that in 26,262 cases treated by injection there were no mortalities that could in any way be attributed to the injection treatments. Hæmorrhage following operation was reported in 0.573 per cent. of the cases and following injection in 0.279 per cent. of the cases. Stricture following operation was estimated at about 0.22 per cent. and after injection methods this group of men had practically no strictures at all. Recurrence of the hæmorrhoids was much more frequent after the use of injection methods, occurring in at least 15 per cent. within three years.

Results from the use of phenol in olive and almond oil compared favorably with the results following the use of quinine urea hydrochloride. The double chlorhydrolactate of quinine and urea proved to be less likely to cause sloughs than quinine and urea hydrochloride.

It is probable that proctologists who are obtaining superior results would be more inclined to answer the questionnaire than those who are having poor results. The above figures show what can be attained in proctology at its very best. The general level of practice does not even approach such a high standard as has just been mentioned. Men who think that they can diagnose hæmorrhoids by digital examination, men who do not know the anatomy and pathology of the rectum, men who treat hæmorrhoids without making a proctoscopical and sigmoidoscopical examination, will continue to bring both methods into disrepute.

The long roster of contributors to this study would include a veritable hall of fame in proctology, and appreciation is due to these men, of whom many have international reputations, who disinterestedly toiled through their case histories to amass reports on these 62,000 cases.

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[12] Pennington showed that many of the common operative procedures, by ligature, clamp, or suture, close up and seal in, infection; and presented photomicrographs to prove this. J. A. M. A., vol. 87, p. 2064, December 18, 1926.

[13] The bactericidal properties of phenol 5 per cent. in oil and quinine urea hydrochloride 5 per cent. were investigated at my request by Mrs. Winifred Russell, bacteriologist for Doctors Brem-Zeiler and Hammack. Phenol in oil was found to be bactericidal to *B. coli* in 2.5 per cent. and quinine urea hydrochloride was found to be bactericidal to *B. coli* in 5 per cent.—not less.

[14] Rectal stricture following operation has in the past been reported in as high as 10 per cent. of cases, even in large case series performed by proctologists of well-known reputation:

E. T. C. Milligan reported an incidence of 11.3 per cent. stricture in a series of 282 hæmorrhoidectomies and in another series of 290 hæmorrhoidectomies an incidence of 9 per cent. stricture. (Proc. Roy. Soc. Med., vol. 23, p. 702, March, 1930). In a recent personal communication, E. T. C. Milligan adds: "The series of cases I reported were the cases operated upon at St. Marks Hospital in the years just preceding the publication and are a new series having no relation to those published by H. G. Anderson and Sir Charles Gordon-Watson previously. They are group statistics and not individual, hence their value. They are the cases of five surgeons—four surgeons performed the 'stripping up operation' and one performed 'clamp and cautery.' It was interesting that the evidence of stricture formation was the same after the clamp and cautery operation. Since abandoning the stripping up operation not one case of stricture has occurred; 450 cases."

Quoted and requoted from one medical journal to another are statements arguing for injection treatment and citing an incidence of post-operative stricture at St. Marks Hospital, London, of 10 per cent. Most of these quotations can be traced back to articles by H. G. Anderson (Brit. Med. Jour., vol. 2, p. 593, October 31, 1909) or by Sir Charles Gordon-Watson (Brit. Med. Jour., vol. 2, p. 593, October 15, 1921). The original articles have been most unfairly quoted; what they do say is: "Forty per cent. (of the ligature cases) had slight constriction easily remedied by digital dilatation, during the third week. Five per cent. had marked contraction requiring dilatation for six weeks. All these did well later and showed no further tendency to constrict, and occurred in patients who . . . neglected digital examination." Brit. Med. Jour., vol. 2, p. 593, October 15, 1921.

Kantor in ninety hæmorrhoidectomies reports eight post-operative strictures and one case of sphincter paralysis. (Am. Jour. Surg., vol. 14, p. 260, December, 1931.) Vernon C. David, who has an almost perfect record in his own cases, reports that of eighteen rectal strictures coming to him after treatment by others, ten were due to operation by clamp and cautery, four to the Whitehead operation, two to diathermy and only two to injection treatment. J. A. M. A., vol. 98, p. 1, January 2, 1931.

[15] Rosser also incriminates, but to a lesser degree, cottonseed oil as a vehicle. In a recent personal communication Rosser adds that these findings occurred in the case of cottonseed oil "when large doses are given": Rosser, Curtice: J. A. M. A., vol. 96, p. 1762, May 23, 1931; J. A. M. A., vol. 99, p. 2167, December 24, 1932.

[16] Such an effort was made in the early days (1879) when the itinerant quacks were deliberately trying to slough out hæmorrhoids. Edmund Andrews who made the effort found that this method made a thorough study impossible. He wrote: "Many of the operators were ignorant blockheads." In 3,304 cases "treated often in the most reckless and ignorant manner" four deaths occurred. (Originally Andrews reported nine deaths but later he corrected this statement, saying that only four deaths were authentic. Med. Rec., vol. 15, p. 451, May 10, 1879.) There were eight instances of suspected embolism of the liver. Only one of them died and there was no post-mortem examination, so that positive proof is wanting. It is probable a portion of the cases the liver disease pre-existed and was the cause of the piles and not the consequence . . . a few cases only of extensive abscesses occurred." In the 3,000 cases "five cases of hæmorrhage are reported . . . The imperfection of the reports renders a thorough study of the accidents impossible." Cincinnati Lancet and Clinic, New Series, vol. 2, p. 327, April 19, 1879.

[17] Of these, five merely wrote in to give answer to this question and gave no statistics.

[18] de Takats, G.: Surg., Gynec., and Obst., vol. 43, p. 100, July, 1926.

PRE- AND POST-OPERATIVE MANAGEMENT OF ANO-RECTAL CASES

AN INQUIRY INTO THE USE OF CERTAIN ANÆSTHETIC AGENTS

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Surgical therapeusis has come to be the treatment of selection in a large number of diseases of the anus and lower rectum. In years gone by the exquisite pain that followed most ano-rectal operations was a definite drawback to surgery of this region. Failures in technic as well as in proper preparation and very likely a lack of interest in formulating plans to ameliorate the post-operative distress were the root of this evil. However, during the last ten years considerable advancement has been made in the reduction of post-operative pain in these cases.

In the pre-operative stage, cleanliness and proper preparation of the gastro-intestinal tube are most important. True asepsis is impossible in this region, yet it is a goal toward which one should strive; surgical cleanliness is about all that may be expected. In preparing for surgery of the lower rectum and anal canal, one should begin by giving a mild cathartic some forty-eight hours before operation to relieve any stasis along the gastro-intestinal tube, thus bringing the fecal material down into the colon where the pre-operative enema may be used to the best advantage. This cleaning out of the gastro-intestinal tract will also help to prevent post-operative distention and gas pains, and there will be less likelihood of a scybala forming. Some hours previous to operation a normal saline enema should be given until it returns clear. After the anæsthetic has been given, the rectum is thoroughly irrigated with a quart of 1 per cent. Lysol solution. Using the index finger, with the aid of a small catheter or rubber-tipped nozzle, one can thoroughly clean the rectum and anal canal, removing any material from between the folds. A small amount of this solution may come down during the operation but the amount is usually negligible. I have found it much easier to wash out the rectum in this manner after a spinal anæsthetic because one secures better relaxation of the sphincter muscle. Gross dilatation and tearing of the sphincter ani will merely increase post-operative pain and spasm. Mercurochrome-acetone-alcohol solution is then applied to the anal canal and gluteal regions.

The selection of operation should fit the individual case. Certain types of operative manipulations and procedures are more apt to produce pain than others. For example, the clamp and cautery operation for hæmorrhoids is bound to set up more painful stimuli than a clean anatomical dissection of the hæmorrhoidal tumors. In operating upon fissures and fistulæ, a wide

saucerization of skin plays an important part in the reduction of pain as well as giving a less distorting operative scar. I never pack a fistulous tract firmly but merely insert a small amount of gauze, which is removed at the end of twenty-four hours and never replaced, the wound being kept open by daily manipulation with a sterile gloved finger and applications of 15 per cent. balsam peru in castor oil. It has never seemed necessary with my patients to insert a tube or catheter into the rectum following operations in this region. Such a rubber tube, particularly if surrounded by gauze, acts as an irritant and promotes peristalsis, thereby increasing pain and abdominal cramps.

It is the first act of elimination which all patients fear and precaution should be taken to reduce this pain to a minimum. If patients are kept on a liquid diet without milk for two days following operation, and such a time elapses before the first bowel evacuation and the lower canal is well protected, the danger of infection is greatly reduced. The amount of pain is in direct proportion to the degree of infection. As a protection for this operative area, one can use an oily substance which will coat over and soothe the area. This may be improved upon by adding some mild antiseptic to further encourage healing. The ideal substance would be something which, in addition to these qualities, possesses some anæsthetizing properties. Such an ointment I have been experimenting with during the last year. It contains both phenol and nupercaine (a hydrochloride of a butyl oxycinchoninic acid diethyl ethylene diamide) in a vaseline base. Because of the possible toxicity of nupercaine and phenol, very small amounts of these drugs were used in the early cases. Gradually the amounts have been increased until now I believe the optimum results are being obtained, although it is possible that slightly greater amounts may be used without injurious effects. Further experiments will decide this issue.

Phenol is an efficient antiseptic and is a local anæsthetic to the extent that it will obtund pain although it does not obliterate all sensation. In such dilute solutions as .25 per cent. to .50 per cent. it will prevent the growth of staphylococcus pyogenes and the colon bacillus in some medias. Phenol is soluble in petrolatum and in an oily base becomes about one-tenth as active. It has been found that the lethal dose for a 150-pound is seventy-five grains (5 Gm.), yet even five-grain (⅓ Gm.) doses may give rise to serious disturbances. When phenol has been used in hæmorrhoidal injections with serious consequences, death has probably been embolic rather than due to the poison. In the later experiments the ointment was prepared by using ninety cubic centimetres (three ounces) of 1½ per cent. carbolized vaseline which has been thoroughly mixed with thirty cubic centimetres (one ounce) of 1 per cent. nupercaine ointment. In an ounce of this mixture there are 337 milligrams of phenol or approximately 1/3 Gm. This may seem rather a large dose when it has been stated that five grains or 1/3 Gm. doses have given rise to serious disturbances. However, in hæmorrhoidal injections we frequently use ten cubic centimetres of 5 per cent. phenol in almond oil.

Here we have 500 milligrams or ½ Gm. of phenol injected directly into tissue where it can be immediately absorbed. With the phenol in a vaseline base and introduced into the rectum, absorption is very much slower. Therefore, there is a wide margin of safety as regards the action of the phenol.

Nupercaine, or what is commonly known as percaine in Europe, has undergone a great deal of investigation. It is known to be effective for local application to mucous membrane surfaces. The toxicity of nupercaine is high, exceeding even that of cocaine, but it is much more effective than cocaine in lower concentrations and is therefore used with less hazard, according to the reports of Gessner and Nauheimer, Lipschitz and Laubender, and Lotheissen. It is also said that nupercaine is slightly antiseptic. Hirsch has stated that as an anæsthetic agent a 1 to 2 per cent. solution is as effective as a 5 to 20 per cent. solution of cocaine hydrochloride. Coming in contact with blood-vessels, nupercaine causes initial vasodilation with subsequent contraction due to a drying effect.

For injections into the bladder, thirty cubic centimetres of a 1-500 solution may be used without hesitance. This amounts to sixty milligrams. For infiltration anæsthesia, 100 cubic centimetres of a 1-1000 solution is perfectly safe. This amounts to 100 milligrams. In preparing the ointment which I have been using, thirty cubic centimetres (one ounce) of 1 per cent. nupercaine ointment is mixed with ninety cubic centimetres (three ounces) of the 1½ per cent. carbolized vaseline. Each thirty cubic centimetres (one ounce) of 1 per cent. nupercaine ointment contains 300 milligrams of nupercaine. When this is diluted with ninety cubic centimetres (three ounces) of carbolized vaseline we have a ¼ of 1 per cent. nupercaine ointment, which amounts to seventy-five milligrams of nupercaine in each thirty cubic centimetres (one ounce) of the mixture. This is well within the margin of safety even if this amount of nupercaine should be injected directly into tissue. When it is introduced into the rectum absorption is slower because the nupercaine is mixed with petrolatum and because all of the ointment is not in contact with the absorbing mucous membrane surfaces. The addition of phenol potentiates the action of nupercaine as it does with cocaine.

At the conclusion of all operations upon the anus and lower rectum, one ounce of this mixture is injected. The all-metal syringe is most useful for these injections. A small amount of the mixture is also placed upon the gauze dressing which is in contact with the anus and upon the small strips of gauze which are used in fistulous tracts.

The action of this combination ointment of nupercaine, phenol and vaseline is four-fold. First, both nupercaine and phenol have anæsthetic qualities and in an oily base the time element is prolonged. Second, they are both antiseptic, particularly the phenol. Third, the phenol is somewhat of a cauterant and probably tends to diminish oozing, and the nupercaine by its drying effect causes vascular contraction. Oozing is also retarded by the pressure and molding effect of the ointment in the lower ano-rectal canal. Fourth, in preparation for the first act of elimination, the lower end of the

intestinal tube is thoroughly anointed with a lubricant possessing anæsthetic qualities.

Following operation, the patient is given a tube of 1 per cent. nupercaine ointment without the phenol and it is applied locally as necessary for relief of any distress.

As stated before, the patient is on a liquid diet without milk the first two days following operation. It is not my custom to give opium or bismuth or any other drugs to "tie up" the bowels during these first few post-operative days. Unless peristalsis is stimulated, the bowels do not want to empty after a rectal operation because of the reflex mechanism. Administration of mineral oil, plain or in combination with agar, is begun on the evening of the second post-operative day and is continued through convalescence or as advised.

After following these measures, the pain of the first bowel evacuation may be further minimized by an injection of six to eight ounces of warm cottonseed oil into the rectum on the morning of the third day. This may be supplemented if necessary by injection of a pint of normal saline.

Hot moist packs or dry heat may be comforting but are by no means routine measures. Hot sitz baths are advised after the first three days and may be continued indefinitely if desired. Doubtless the patient will require some morphine and codeine during the first few days and he should always be permitted to have a restful night.

When the patient is discharged from the hospital, in most cases at the end of five to seven days, he is advised to return on the tenth post-operative day and two or three times a week for several weeks thereafter, for digital ironing out and digital dilatation of the anal canal. This does a great deal to prevent painful post-operative spastic anus and stricture formation.

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THE PULSES OF THE FOOT

THEIR VALUE IN THE DIAGNOSIS OF PERIPHERAL CIRCULATORY DISEASE

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Introduction.—The recognition, in routine practice, of peripheral circulatory disease, particularly in the lower extremities, has been markedly improved of late years through more efficient differentiation of this condition from static foot disabilities. Buerger[3] and others have called attention to certain definite signs facilitating the diagnosis of peripheral circulatory disease, the most generally used of which has been the palpation of the foot pulses in estimation of peripheral arterial circulation. Since many cases have been erroneously diagnosed as peripheral circulatory disorder through apparent but not actual absence of foot pulses, this study of the arterial pattern and of the obscuring effect of superjacent soft tissues was undertaken to elucidate the problem.

Diagnosis.—The circulatory lesions have been so thoroughly classified by Brown and Henderson[2] that they require no further exposition than that given in Table I.

Table I

Classification of Peripheral Circulatory Lesions

Functional or vasomotor types	Local distribution	Vasoconstricting types	1. Multiple-phase color reaction: Raynaud's disease 2. One-phase color reaction: acrocyanosis, dead finger, local syncope
		Vasodilating types	Erythromelalgia
	General distribution	Vasoconstricting types	Primary or essential hypertension, early stages
		Vasodilating types	Primary or essential hypotension
Organic types	Local distribution		1. Arteriosclerosis, with or without thrombosis; diabetic gangrene 2. Thrombo-angiitis obliterans 3. Simple thrombosis or embolism 4. Arteritis of known infectious origin (rheumatic, syphilitic) 5. Aneurism with or without thrombosis
	General distribution	Arteriosclerosis	1. Primary 2. Secondary to hypertension

Whereas advanced circulatory disturbance is easy to recognize, the very early stage or mild case presents much more difficult problems of diagnosis. Buerger[3] calls attention to the drop in local temperature and loss of natural color in the area affected by the occlusion. A clinical difference in temperature which may or may not be confirmed by the thermometer is pathognomonic of peripheral circulatory disease and if the disease is not very extensive, the toes alone show the sign. Elevation of the leg to 90° produces pallor and ischæmia, and the speed of return to normal circulation when the limb has been lowered is a rough measure of the disturbance. Samuels[10] emphasizes the cadaveric pallor of the sole when the ankle-joint of the vertically elevated limb is alternately and rapidly plantar-flexed and dorsi-flexed.

There are several instruments of precision designed for study of the efficiency of the peripheral circulation. Among these are the oscillometer test which is somewhat analogous to the sphygmomanometer, the intradermal saline test of Stern and Cohen,[11] and the thermocouple as advocated by Brooks. All writers have referred to the pulses of the foot as a cardinal criterion of peripheral circulatory efficiency. Buerger[3] considers absence of the dorsalis pedis pulse a very important sign in the diagnosis of peripheral circulatory disease since, in his experience, absence of this pulse occurs merely in one-half of 1 per cent. of healthy feet. He bases this percentage on the examination of 200 known normal individuals. However, he quotes Erb as having found absence of the dorsalis pedis pulse in 2 per cent. in the examination of 700 known normal individuals. In my observations upon 500 healthy individuals, I have found absence of the dorsalis pedis pulse in 4 per cent. and of the posterior tibial pulse in 5 per cent. In a further 8 per cent. a positive dorsalis pedis pulse was found in other than the common position.

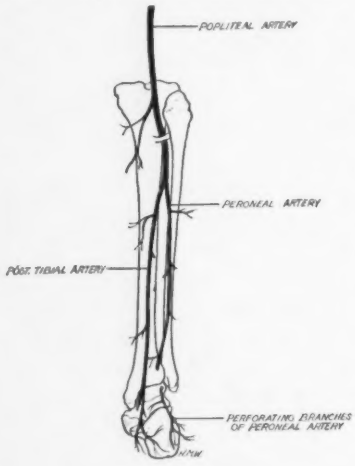

FIG. 2.—Usual pattern of arterial tree in dorsal aspect of leg.

VARIABILITY OF THE ARTERIAL TREE. I. *Dorsum of the Foot.*—Figs. 1 and 2 illustrate the arterial circulation for the dorsum of the foot and for the dorsal aspect of the leg below the knee as a basis for consideration of deviations from the usual pattern. These figures show the topographical relationships so clearly that no further exposition is necessary.

The observations comprised in this report were made upon the seventy legs of thirty-five white cadavera in the anatomical laboratory.

In one example only (1.5 per cent.), the distribution illustrated in Fig. 3 was found. The anterior tibial artery subdivides at the usual site into a larger tarsal artery and a smaller dorsalis pedis which continues downward over the talus, navicular and cuneiform and then between first and second metatarsals, giving off, in its course, the first dorsal metatarsal branch and the branches to first and second toes. In this specimen the arcuate artery is a branch of the lateral tarsal. Owing to its small calibre the dorsalis pedis of

this foot could easily be overlooked but a pulse would be palpated in the lateral tarsal artery over the lateral cuneiform bone.

The next group of two instances (3.0 per cent.) showed a complete absence of

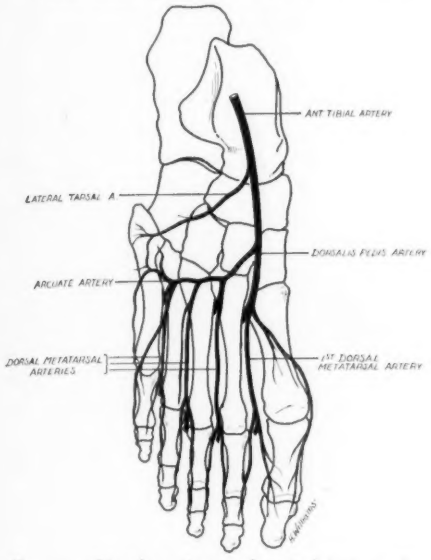

FIG. 1.—Usual pattern of arterial tree for dorsum of foot.

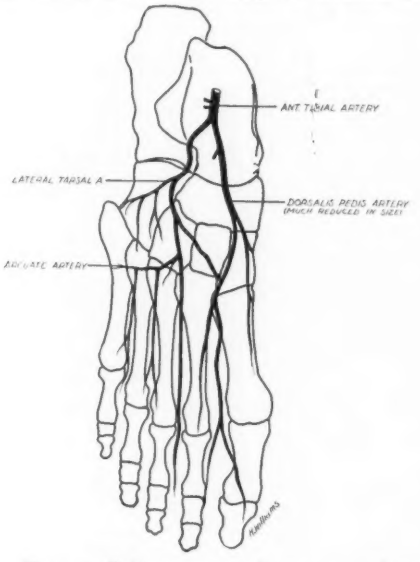

FIG. 3.—Pattern present in one out of 70 feet (1.5 per cent.). Dorsalis pedis of small calibre. Lateral tarsal easily palpable.

dorsalis pedis as an independent vessel. It becomes merely a loop in the arterial pattern of the dorsum. The first interosseous space was supplied in one specimen by the dorsal arterial tree (Fig. 4) and in the other from the medial plantar artery.

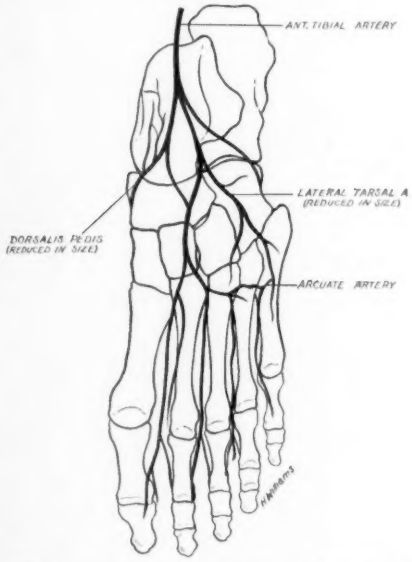

FIG. 4.—Absence of dorsalis pedis as an independent vessel (two out of 70 feet, 3.0 per cent.).

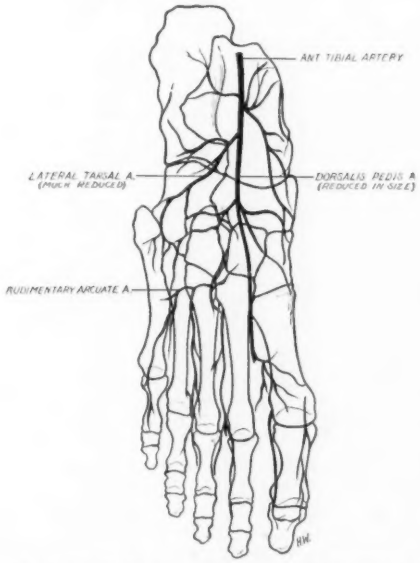

FIG. 5.—Reduction of anterior tibial and its branches with increasing participation of arteries of sole in supply of dorsum (3.0 per cent.).

In two feet (3.0 per cent.) the dorsalis pedis was not recognizable even as a loop and the anterior tibial continued downward as a central channel much reduced in size.

The plantar arteries take a very prominent part in the supply of the dorsum the pattern of which becomes quite complex as its constituent channels are small and clinically non-palpable. (Figs. 5 and 6.)

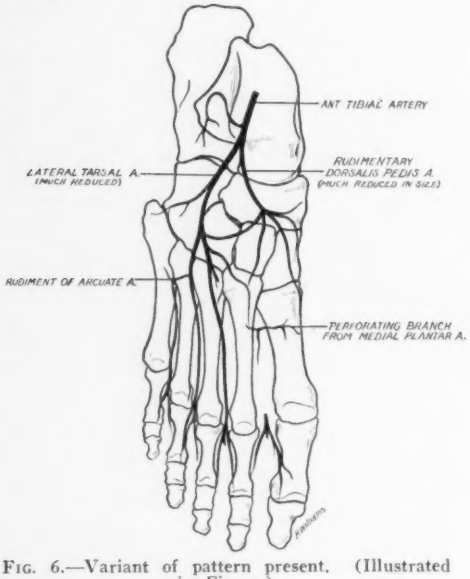

FIG. 6.—Variant of pattern present. (Illustrated in Fig. 5.)

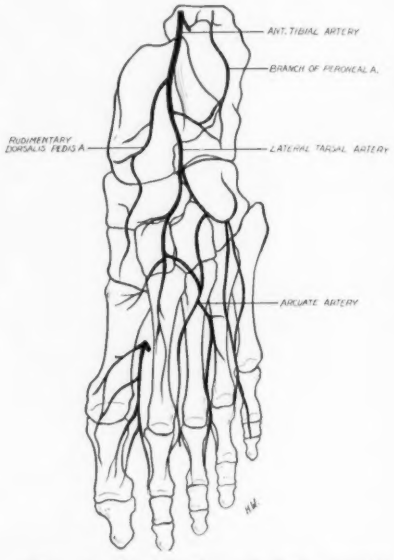

FIG. 7.—Participation of both anterior peroneal and plantar arteries in pattern of dorsum. Dorsalis pedis rudimentary.

In six specimens (9.0 per cent.) we find an increasing participation by the anterior peroneal branch from the posterior tibial artery in the vascular pattern of the dorsum of the foot. Fig. 7 shows an early stage of this condition when the plantar vessels still

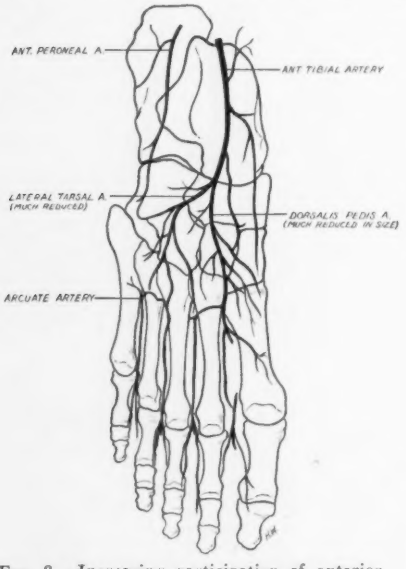

FIG. 8.—Increasing participation of anterior peroneal artery from posterior tibial.

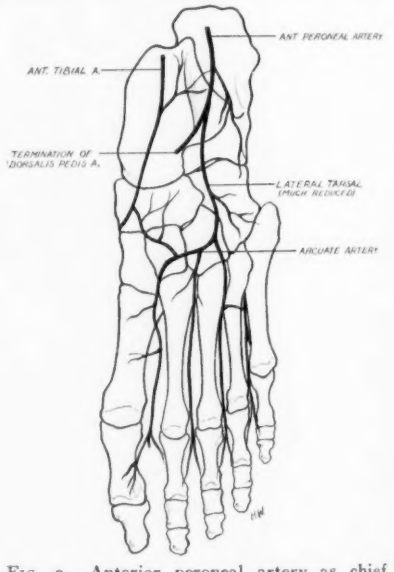

FIG. 9.—Anterior peroneal artery as chief source of arterial pattern on dorsum.

take a prominent part and the dorsalis pedis together with the lateral tarsal and arcuate vessels are so small as not to be clinically palpable. In Fig. 8 the anterior peroneal forms a loop with the much reduced tarsal artery. The plantar vessels are an important

source of arterial blood to the dorsum in this specimen. In Fig. 9 the anterior peroneal artery becomes the chief source of arterial blood to the dorsum of the foot. The anterior tibial is reduced to a mere thread and the contribution from the plantar vessels is meagre.

A very simple summary can be made of these variations obviously following reduction in size of the anterior tibial artery. The dorsum of the foot derives its arterial supply from three sources, namely, directly through the anterior tibial; from the plantar vessels; indirectly from the posterior tibial artery through its anterior peroneal branch. The anterior tibial vessel divides unequally into dorsalis pedis and lateral tarsal. The standard description figures the dorsalis pedis as much the larger but occasionally the lateral tarsal is found to be the predominant vessel. Reduction in size of the anterior tibial results in the participation of the plantar vessels through their perforating branches or of the posterior tibial through its anterior peroneal

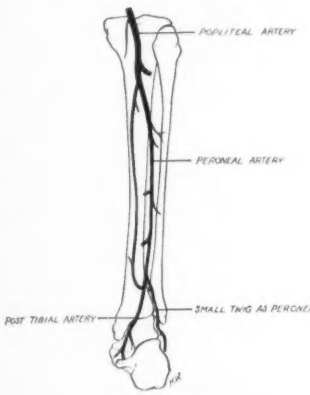

FIG. 10.

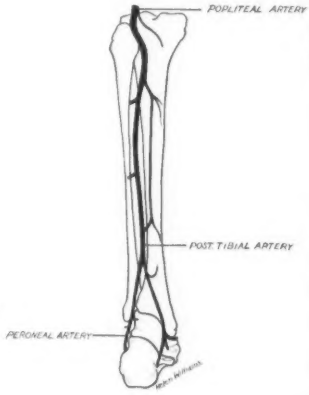

FIG. 11.

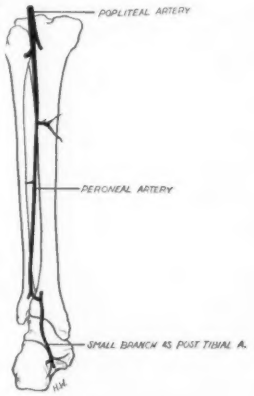

FIG. 12.

FIG. 10.—Peroneal artery forming the chief arterial trunk of the posterior crural region (1.5 per cent.).
FIG. 11.—A further stage in reduction of the posterior tibial artery in the calf (1.5 per cent.).
FIG. 12.—Practical elimination of posterior tibial artery as a vascular trunk (1.5 per cent.).

division. Both these sources may be drawn upon. In this study, however, the anterior peroneal seems to play a greater part in the re-distributed pattern.

II. *Dorsal Aspect of the Leg.*—A study of the posterior crural region of the same seventy legs revealed the following significant anomalies, each of which, however, occurred only once (1.5 per cent.).

The first of these, Fig. 10, showed a popliteal artery bifurcating rather high into its two customary branches, of which the peroneal artery was obviously the main branch, while the posterior tibial remained as a channel of small calibre forming a long loop with the peroneal. After the latter had given off a small branch distributed as anterior and posterior peroneal vessels it continued downwards as the source of arterial supply to the foot, thus taking the place of the posterior tibial trunk.

In the second anomaly, Fig. 11, the distribution is essentially the same but the posterior tibial loop is much smaller and both the channels which take the place of the regular posterior tibial and peroneal vessels are quite small.

The former anomaly would not result in an impalpable posterior tibial pulse but the second anomaly would have presented, during life, a really difficult problem of palpation.

The third anomaly, Fig. 12, shows a complete attenuation of the posterior tibial loop except at the points where this loop joins the main arterial trunk formed by the posterior tibial. This vessel gave off a very small posterior tibial and a still smaller peroneal branch.

It is obvious that reduction in size of the posterior tibial vessels with its resultant effect upon the vessels of the sole can occur only in those legs the anterior tibial and dorsalis pedis of which are comparatively well developed. The result of this study is therefore the conclusion that the vessels of the leg below the knee present a pattern of a somewhat unstable character altogether different from that constant and very clear-cut picture which one obtains from the regular text-book description. Some explanation of this obvious contradiction must be sought if our results are in any way borne out by the careful observations of other workers.

Comparison of Published Observations.—The literature gives no clear picture of the contribution to the arterial pattern of the dorsum derived from the anterior peroneal artery.

Out of 250 Japanese feet Adachi[3] reports 199 having a large dorsalis pedis: in nineteen, dorsalis pedis and lateral tarsal were both of approximately the same calibre: in twelve, the lateral tarsal was the principal vessel.

Among 200 Italian feet Salvi[9] found 137 in which the dorsalis pedis pulse was more palpable than the lateral tarsal: in thirty-five the lateral tarsal gave the main arterial contribution to the dorsum.

Corsy[4] found that sixteen out of fifty new-born European infant feet showed a lateral tarsal artery much larger than the dorsalis pedis.

It is true that Salvi reports an incidence of 17.5 per cent. of predominant lateral tarsal arteries, whereas Adachi records only 5.2 per cent. and reports this difference as a true racial characteristic. From the difficulties of observation it might be equally probable that the difference is really more in the sample than in the human stock.

The peroneal artery, according to Adachi, is very often larger than the posterior tibial and such legs usually show a small anterior tibial vessel: the peroneal artery is indeed unusually constant. When there is extreme attenuation of the posterior tibial vessel it usually ends in the upper third of the calf by terminating as a muscle branch or as a nutrient artery of the tibia. Out of 486 Japanese legs the posterior tibial artery was very small in thirteen and absent in ten, a combined total of 4.9 per cent.

Among 211 English legs, Thane[8] found the posterior tibial very small in seven and wanting in eleven when the peroneal, as expected, furnished the plantar artery.

Among sixty-six Italian legs investigated by Manno,[6] the posterior tibial ended six times in the lower third of the leg by dividing into plantar and peroneal arteries.

Dubreuil-Chambardel[5] found a diminution of the posterior tibial artery in eight out of 103 French legs.

The above observations, in summary, show that twenty-three Japanese legs out of 486 (4.9 per cent.) and twenty-four European legs out of 277 (8.7 per cent.) either possessed no posterior tibial artery or a vessel much reduced in size. The racial significance of this difference does not appear proven in view of the great variability to be found among the samples of different writers. These differences have been set forth in Tables II and III.

The Origin of the Arterial Pattern.—The diverse and apparently bizarre variations in arterial distribution to the dorsum of the foot find their explanation in phylogenetic history. The anterior and posterior tibial arteries appear

TABLE II

Arteries: Dorsum of Foot

	No. of limbs studied	Dorsalis pedis artery larger		Lateral tarsal artery larger		Dorsalis pedis artery small or absent		Lateral tarsal artery small or absent		Dorsalis pedis and lateral tarsal arteries absent	
		No.	%	No.	%	No.	%	No.	%	No.	%
Adachi	250	129	51.6	12	5.0						
Salvi	200	137	68.5	35	17.5						
Reich	70	52	74.0	5	7.0	10	14.2	8	11.4	3	4.2

TABLE III

Arteries: Dorsal Aspect of Leg

	No. of limbs studied	Posterior tibial artery absent		Posterior tibial artery small	
		No.	%	No.	%
Adachi	486	10	2.0	13	2.6
Thane	211	11	5.0	7	3.3
Manno	66	6	9.0		
Dubreuil-Chambardel	103			8	7.8
Reich	70	2	2.8	2	2.8

to be special features of human anatomy derived from the anastomosis of muscular vessels which carry the popliteal circulation into the lower leg. In primates the femoral artery is continued characteristically into the leg as the saphenous artery which accompanies the saphenous nerve and great saphenous vein to the region of the ankle.

This artery has been studied in recent years by Popowsky,[7] who gives a summary of previous observations on the vessel and its termination. Popowsky points out that the saphenous artery descends quite superficially on the medial surface of knee and leg. In certain primates the vessel gives off a posterior branch which, descending behind the inner malleolus, gives origin to the plantar arteries of which the medial is phylogenetically the earlier developed of the two. The saphenous artery itself continues as the dorsalis pedis. After differentiation of the posterior tibial artery as a connecting link between popliteal and plantar vessels the peroneal artery makes its appearance by the continuity of an anastomotic chain. Still later, but in the same manner, the anterior tibial artery develops from an anastomotic chain connecting popliteal with dorsalis pedis. This phylogenetically new vessel reaches its full development in man alone in whom the saphenous artery is lost. Popowsky, however, found traces of it in two fœtuses of five and six months, respectively. In these the saphenous artery terminated in the middle of the lower leg behind the saphenous nerve.

It is plainly due to the relatively recent transformation in vascular pattern of the human leg and foot that the arterial channels of the dorsum present so variable a character.

Clinical Application.—Out of the seventy limbs studied fifty-two (74 per cent.) had predominant dorsalis pedis arteries; the lateral tarsal artery was the larger vessel in five (7 per cent.); in ten (14 per cent.) the lateral tarsal was the main artery of the dorsum of the foot.

Seven times in our series the dorsalis pedis was very small; it was entirely absent in three (4.5 per cent.); the lateral tarsal artery was small in five (7 per cent.) and entirely absent in three (4.5 per cent.); in three legs (4.5 per cent.) both the dorsalis pedis and lateral tarsal arteries were absent.

Comparing these results with those of Adachi and Salvi I find myself in closer agreement with Salvi, particularly in the frequency of a larger lateral tarsal artery, for all my specimens were from white subjects.

As for the posterior tibial artery, I find it absent in four legs (6 per cent.) and very small in two (3 per cent.). These results compare favorably with those of other European observers, notably Thane and Dubreuil-Chambardel, whereas in the Japanese, Adachi found anomalies of the posterior artery in approximately half this number.

In white subjects one may safely conclude that the dorsalis pedis artery can be palpated in 75 to 80 per cent. of lower extremities and the lateral tarsal artery in about 14 per cent. In other words, approximately fourteen times in a hundred, if the dorsalis pedis pulse is not found in its usual location, one should feel for a pulse more laterally situated on the dorsum of the foot, approximately over the head of the third metatarsal bone.

Both pulses of the dorsum of the foot are absent in approximately 4 per cent. of European legs. In these no pulse whatsoever can be palpated on the dorsum of the foot. In about 4 per cent. both dorsalis pedis and lateral tarsal pulses may be equal but much reduced in volume so that a dorsal pulse is found with difficulty and sometimes not at all.

There is no posterior pulse in the 3.5 to 5.0 per cent. of legs in which the posterior tibial artery is absent and in a further 3 per cent. the pulse is very weak.

Besides the arterial anomalies which make palpation of the pulse difficult or impossible there are two other important factors to be considered, namely adiposity and œdema. In addition, the ligamentum laciniatum, covering the posterior tibial artery as it proceeds downward around the malleolus, may conceal this pulse even if the vessel is normal. These factors exaggerate the frequency of non-palpable foot pulse.

We may apply these results to the diagnosis of circulatory diseases of the lower extremity below the knee. Presence of pulses of the foot rules out circulatory disease; absence of the pulses of the foot is an important aid in diagnosis if supported by other more positive evidence but in doubtful and border-line cases absence of the pulses of the foot must not be construed as a pathognomonic sign because of the relative frequency of obscured or irregularly placed foot pulses, a condition rendered still more confusing by the presence of adiposity or œdema.

Conclusions.—(1) Whereas palpable foot pulses in dorsalis pedis or lateral tarsal arteries are contraindications of peripheral circulatory disorder, apparent absence of these pulses must not be construed as evidence of disease without the definite confirmation by positive signs.

(2) Extracirculatory factors not infrequently diminish the ease with which the pulse may be felt. These are œdema, adiposity and the obscuring influence of superficial soft tissues, whether tendons or ligaments.

(3) The arterial tree of the foot is sufficiently variable to throw doubt upon the value of negative evidence. Details of the anomalous patterns and their frequency are recorded in the body of this paper.

(4) Both tibial arteries and the peroneal vessel are of relatively recent origin. They are formed from anastomotic chains of arteries supplying the muscles of the calf and ventrolateral aspect of the leg. In primates other than man the popliteal artery ends in muscular vessels while the vascular supply of the foot comes from the femoral artery through a vessel usually absent in man, namely, the saphenous artery, which continues as the arteria dorsalis pedis and gives off a posterior branch providing the plantar vessels to the sole.

In man alone of all primates is found the complete pattern of new connections between popliteal artery and distribution on dorsum and sole of the foot. Hence the frequency and variety of arterial pattern described in the body of this paper.

(5) There appears to be a racial difference in frequency since observations made by different investigators upon the feet of white subjects are in general agreement, whereas those equally carefully carried out by Adachi on Japanese feet present a smaller incidence though not a different classification. But one should beware of drawing positive conclusions of real racial difference since the frequency in random samples is apt to be determined by many conditions which are uncontrolled in investigations of this nature. The actual clinical frequency of circulatory disorder would be a more reliable criterion.

(6) The anatomical structure of ankle and foot forces us to rely upon the arterial distribution of the dorsum of the foot for our information and the dorsum is clearly less significant as a source of general blood supply to the foot than is the plantar aspect, the arteries of which are too deeply placed and too greatly obscured by the heavy superficial structures to be available in diagnosis.

Summary.—Whereas palpable foot pulses in dorsalis pedis or lateral tarsal arteries are contraindications of peripheral circulatory disorder, apparent absence of these pulses must not be construed as evidence of disease without the definite confirmation by positive signs.

Extracirculatory factors not infrequently diminish the ease with which the pulse may be felt. These are œdema, adiposity and the obscuring influence of superficial soft tissues, whether tendons or ligaments.

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DISABILITY DUE TO SWELLING FOLLOWING TRAUMA OF THE EXTREMITIES *

POST-TRAUMATIC PERI-ARTICULAR FIBROSIS

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There are many medical and surgical problems which by reason of their anatomical location have not as yet been made sufficiently clear by a pathological study of their histology and physiology to afford a complete understanding of the fundamental changes present. Such circumstances preclude the certainty for therapeutic measures that is afforded by diseases in which the pathological changes have been worked out sufficiently to develop specific indications for treatment. There is sufficient evidence in the historical past of deductions made from clinical observations in tissue reactions to warrant such observations being discussed today.

I propose to describe a common condition with the idea that though these observations as to its cause may contain errors, I may stimulate such work as will prove them false or develop a modicum of truth. From such truth as might develop, I would look for a better understanding of the late lesion with improvement in the treatment of it which is now unsatisfactory. From what I have seen clinically, I do not feel under the necessity of apologizing for speaking of so simple and frequent a thing as swelling, and that which may follow it.

The disability due to stiffness of the fingers, with pain in the interphalangeal joints on movement, which follows the swelling incident to trauma or infection of the forearm, wrist, or hand, I think one will concede is not only a too frequent condition, but one that dramatically demonstrates function loss. I believe that a similar condition may, and does exist in the foot from the same causes. The loss of function in the foot following injury is not so graphic as in the hand, because of the lesser degree of mobility in the joints and the obscurity of visible coördinated movements which occur in the joints of the feet during function. However, if one will disregard the apparently small degree of lost joint action in the affected foot, and will judge function loss, as presented by painful joints in a limb bearing weight, there is added to the objective picture of a limp, an increase in the intangible subjective symptom pain, which starts the vicious cycle of muscle spasm, contracture, *etc.*, and to emphasize any procedure which might prevent some of these should not be considered out of order.

My attention was attracted to this condition some years ago in the Out-Patient Department of the Roosevelt Hospital. It has been a subject of

* Read before the New York Surgical Society, October 25, 1933.

intense interest ever since. An outstanding problem in our work was the swelling of hands and feet that occurred in cases of fracture and infections of the forearm, wrist, hand, and fingers. We noticed that in certain cases, such as children, adolescents, or young adults, this swelling disappeared in direct proportion to the improvement of the initial condition which caused the swelling, and no sequelæ followed. In still another group, most commonly in adults over thirty, though not necessarily determined by age, the swelling was followed by a condition of loss of function in the interphalangeal joints with pain on movement of these. These symptoms appeared late, and remained long after the condition for which the patient sought relief had been cured, provided a distinction was made between the original condition and the sequelæ. The latter is usually interpreted as part of the primary lesion, as the swelling which initiates the late process is a prominent symptom of the first. When the original condition is so treated and the sequelæ are prevented, the separation of the two entities then becomes evident.

In this ambulatory out-patient service, with the patient's limbs of necessity dependent for a considerable time daily, we made our dressings loose to prevent swelling from constriction. This did not prevent the process. We recognized the relationship of swelling, and in considering it as a cause we finally decided that there was an œdema distal to the œdema associated with the trauma, or infection of the primary lesion, and augmented by a dependent position of the limb which was different from the other œdemas. The former preceded the disabling sequelæ under discussion, and there was a direct relationship between the two in that when the distal swelling was absent or prevented, the disability did not appear, or did so to such a minor degree that the time of convalescence was not greatly prolonged.

When the opportunity of treating in-patients later presented itself, where closer observations could be maintained, and the results of continuous elevation in preventing swelling could be watched, I was impressed with the fact that meticulous adherence to the rule that the limb be kept above the level of the heart during the time when œdema showed any tendency to develop or persist, tended to prevent these incapacitating and undesirable joint changes which became more pronounced during convalescence from the primary injury. The heart level is used as it is a location which most patients know, and is a position in which lymph and venous return are aided to the greatest degree in the absence of muscle activity.

I feel at present that in the largest percentage of cases, if the condition develops, it is due to the fact that there has been either too great a trauma, or the directions for elevation and non-constrictive dressings have not been explicit enough, or insufficient attention has been paid to positively determine if adequate directions have been carried out, or rarely there is some systemic disease, focal infection, or dyscrasia which require other added measures of treatment.

The early studies were carried out on simple fractures, and as the essential features of the condition were better understood, the same principles of

treatment were applied to cases of infection occurring in these regions. The results obtained appeared to substantiate the hypothesis formulated as to the rôle that œdema played in the production of fibrosis around joints distal to an inflammatory process, but not proximal to it.

I have for several years called the condition post-traumatic peri-articular fibrosis, using this long term as one might use X Y Z in a problem until he can work out the unknown values. The reasons for the terms used are, it develops within a short time after a trauma, proximal to it, using the term trauma in its broadest sense, *i.e.*, chemical or physical injury which produces a local reaction of inflammation. Peri-articular because the outstanding and persistent lesion in the hand is a slight peri-articular enlargement which appears to be an expression of the most obvious cause that limits the movements of the interphalangeal joints. This limitation is proportionate to the local degree of the process and varies from no movement to a mere subjective sense that the fingers cannot close to make a fist without some degree of pain in these joints. Fibrosis is a questionable term to use in a condition the actual pathology of which is unknown. I have used the term to strengthen my assumption that there must be a peri-articular productive process which follows swelling and persists for varying periods after this swelling has subsided.

In treating cases, this term has emphasized to me that there is a type of swelling easily treated at one period, that if neglected and allowed to persist will leave a productive process to deal with which is disturbing to both patient and surgeon, and resistive to all forms of treatment.

In a certain mild group, it may be only a cell infiltration of the peri-articular structures of short duration which an improved state of circulation will clear up quickly. The extreme type is so slow in clearing up that I have felt that true fibrous changes could be the only explanation for the long period of convalescence, or the permanent fixation which may develop in the terminal joints.

Quoting Adami,[1] "Mere obstruction to the main lymphatic trunks from a part does not lead to complete stagnation of lymph; on the contrary, there is a continuous interchange between it and the blood in the capillaries. Nevertheless, there may be set up continuous and prolonged distention of the parts and this similarly is followed by fibrosis, diffuse in this case. Such appears to be the explanation of the commonest forms of elephantiasis, the fibrosis of macroglossia, and other cases of lymphatic obstruction whether congenital or acquired."

The question arises, is the œdema in the immediate vicinity of a fracture or infection the same as the swelling in the distal part of the same limb? I believe they are similar in some respects, but must of necessity differ in others. They are grossly similar if we look at the distention of the soft parts. They undoubtedly differ in intensity and local inflammatory signs. The proximal swelling of the lesion may be modified by elevation, while the distal swelling can usually be largely prevented. This is dependent upon

the nearness of the proximal lesion to the distal one. As the position of the proximal lesion advances towards the distal part of the limb, the contrast is lost between the two lesions; but even in such a case elevation will aid in the repair of the primary one, and in preventing the secondary one by improving the vascularity and lymph drainage of the part, provided a postural ischemia is avoided.

From a study of the œdemas, I cannot explain the productive fixation process following swelling. I believe the cause must be a complex one. It will not be worked out from the pathology of the mortuary, but must be developed from clinical and experimental work in which the various stages can be studied of changes in circulation, lymph, tissue cells, intercellular fluids, and hormone activity.

There is every degree between the mild and the advanced type of the lesion with the degree of pain of function proportionate to the severity of the process. At the stage of swelling, this pain is not marked; but as the generalized swelling subsides and leaves the enlargement about the joints, pain becomes prominent. Later the enlargement is not so marked as is the pain on movement. If complete fixation occurs in the joints, pain then stops. The cause of the pain I believe is not due to a neuritis with its pathological changes, but "due to the changes in the spatial relationship of the terminal sensory nerve endings" about the joint, when they are pressed upon by the increased pressure of the fibrous tissue upon extremes of movement. These joints are subject to weather change discomfort. I do not believe that the fibrosis is confined to the peri-articular tissue, capsule, and joint ligaments alone; but consider there is a lesser involvement of all the soft tissues which of necessity have to move on each other when a joint activates.

The clinical picture usually presented in the hand is as follows: A patient is treated for an injury or infection of the fingers, hand, wrist, or forearm. The hand becomes swollen. This is greatly increased if there are constricting dressings. If all dressings are removed, and the hand is placed in a dependent position, as in a hot bath, the position alone causes it, provided the position is maintained without periods of elevation. A forearm in loosely applied splints for a fracture, unless held elevated, will develop the swelling and this in direct proportion to the degree of the proximal injury. The soft tissues of the fingers become distended with fluid. This fixes or splints the interphalangeal joints, as blowing up a collapsed rubber toy balloon causes it to become firm. When the swelling has attained this degree, the fingers are held in a slightly flexed position of repose, the joint wrinkles and palmar creases are absent, the skin has lost its normal appearance, is pale or slightly cyanotic, and cannot be pinched up, the palm and fingers may be slightly moist. There are no changes in the nails or eponychium. The œdema is relatively a soft pitting one, and can be massaged out to a considerable degree. If this picture is allowed to continue for over a period of two weeks, or longer; or where the severity of the proximal lesion has diverted attention from the swelling of the hand or foot and it is permitted to exist, the swelling may appear to be less, but of a more stubborn type with the tissue about the joints more prominent. The eponychium at this stage becomes flattened, pale, and extends out on the base of the nail. The nails have the appearance of being unused, as to the finger pads. The fingers taper from the knuckles to the tips and look more pointed with the joints more prominent.

Active movements take place in the metacarpo-phalangeal joints rather than in the inter-phalangeals, and a fist cannot even be started. The distal joints lose their function first, then the proximal ones, and lastly the metacarpophalangeal. As the development of the process progresses and matures, the degrees of function are always less in the distal joints. The pain is in inverse ratio, the less movement existing, the more pain there will be upon activation until fixation. Careful examination of each joint will show a few degrees of active and passive movement without pain; but to exceed this non-painful arc will produce pain in the joint proportionate to the extent that the joint is flexed. This is not due to the fixation of the tendons in their sheath by plastic exudate, as each joint shows varying degrees of movement. There is no pain or crepitus in the tendons, and unless the insertions of the tendons which are so closely related to the capsules be part of the picture, it appears to me that the tendons have little to do with it. Limitation of motion apparently is due largely to a peri-articular productive process which is slightly tender on firm pressure and causes pain when extremes beyond non-painful arcs are exceeded. The process in severe cases may extend to the carpal or wrist-joints.

Making due allowance for the difference in the anatomy of the foot as mentioned before, the loss of joint movement is not graphic; but if one will visualize an analogous painful process in the joints of the feet, the discomfort of moving these joints in walking can be appreciated when these members have to support the body weight.

The condition likely has been called many names, and the cause ascribed to as many others, but I am unable to find a concrete description of it. Traumatic arthritis might seem an appropriate name; but this term conveys the idea that these joints have been the site of the original trauma, whereas they are a complication, or sequela as you please, of an injury, proximal and at some distance from the affected point. There is no synovial effusion, no joint crepitus, and they do not present the picture of having been injured. They are not infections unless affected by the presence of focal infection elsewhere, and they do not show the redness of the skin of acute inflammation.

X-ray shows early and prolonged decalcification of the bones with slight increase in the density of the peri-articular tissues. The bone decalcification is a most persistent part of the picture and requires more than "atrophy of disuse" to explain it. The muscles activating these joints undergo an atrophy of disuse which is added to that produced by the primary injury.

Among the œdemas which do not cause it are generalized anasarca, œdema of the legs or arms unassociated with injury or infection, ligation of the vessels of a limb, a severance of nerves, sensory or motor, excluding trophic disturbance, unless the associated injury is severe. The nearer to the trunk the primary lesion is, the less apt are the sequelæ to cause stiffness in the hands or feet.

As the most common œdemas do not produce this condition, may we not suggest that in an œdema of the distal part of a limb secondary to trauma, something is activated which produces the disturbance in cellular activity in the distal tissues dependent upon lymph stasis and circulatory changes, which ultimately causes a fibrosis at a point of meager vascularity about the joints. The prevention of lymph stasis and circulatory changes will avoid this causative factor.

Differential diagnosis must exclude fixation of tendons either in an infected or adherent scar, or to adhesions in their sheaths. Acute exacerbation of a chronic arthritis, or the more rare Neisser infection must also be ruled out.

In cases of chronic arthritis, this condition due to injury may present itself and aggravate the former. In itself, it is a multiple arthritis, and any case which has an arthritic background should be carefully guarded against its development.

Volkmann's contracture can be readily determined as a muscle lesion; but the etiological factor which produces a Volkmann's pathology may produce the peri-articular one; and the added difficulty of treating and regaining lost muscle action when joint function is absent, becomes obvious.

Treatment.—I am firmly convinced that this condition can be prevented to as large an extent as many of our so-called preventable diseases are prevented at the present day. I am also fully convinced that whatever the unknown values of XYZ proves to be, a recognition of the possibility of such a condition supervening in any trauma of an extremity together with the possibility of its prevention or mitigation by suitable measures makes it incumbent on the medical attendant to add to local treatment such measures as will tend to prevent its onset.

It is prevented by taking care that such swelling as might follow or accompany any trauma or infection of a limb is kept down to a minimum degree until the cause of the swelling has subsided. If this is done, muscular action will facilitate and tend to overcome capillary and lymph stasis. If the increased lymph pressure in the extremity is prevented, the capillary circulation is improved as can be demonstrated on any open granulating wound. Rings should be removed, or cut off the fingers. Dressings surrounding a limb should be neither constrictive nor applied so that they cannot be released sufficiently and quickly to stop the onset of swelling due to these. Adequate cotton padding should be placed on splints, about, and between dressings and bandages to permit a safety factor against swelling and constriction. Fractures should be reduced to a satisfactory position at the earliest possible moment. Localized infections and incompletely drained pus pockets should be opened at the earliest possible moment. Infections which are unlocalized should be given hot baths or local moist heat with elevation judiciously and energetically applied until the œdema has subsided or the infection localized. Dressings should not be applied dry and afterwards wet, as the bandages shrink when moistened.

Adequate splinting of trauma or an infection avoids the spasm of muscle splintage and promotes more comfortable voluntary activity of the fingers and toes. In reapplying splints which have been removed to permit massage for swelling, care should be taken to avoid rebandaging them as tightly as before removal.

The most important feature is that the distal end and as much of the whole extremity as is possible be maintained as high as possible above the

level of the heart until all tendency to swelling has subsided. This obtains in either the sitting or supine position. Where this is not effective, gentle massage by a masseuse or the surgeon with the dressings removed, must be used to combat the swelling of the fingers or foot.

An ambulatory patient with elbow flexed and hand on chest above the heart is in an incorrect position, though in a better one than hanging down with the forearm horizontal. There may be frequent brief periods of respite during the day from these elevated positions to afford increased circulation for repair. The presence of finger and toe-joint creases and wrinkles at all times is imperative. If elevation does not afford this picture, the dressings are too tight and must be loosened as soon as possible, or there may exist increased tension from undrained infection. The surgeon who uses dressings which cannot be loosened without his personal attention should arrange to cope with this problem before it is too late. Non-padded split plaster encasements fulfill this dictum for plaster dressings.

The apparently simple procedure of getting either an interne, nurse, or patient to understand the importance of carrying out directions for sufficient elevation is a most difficult and arduous task. They must be given specific illustrations as to the method, and this followed with daily, I might say, hourly observations until the patient can be made to understand what is wanted, what is effective, and what is not effective.

The persistence for only a few days of a very moderate degree of swelling will initiate the process, especially in a certain type of individual. I have no means of identifying this type, except age is a predisposing factor. What can be prevented will not have to be treated; but once it is established, the outlook is one of prolonged convalescence lasting for months. Recovery will not take place for a period of eighteen months. My experience has been that most cases clear up, the severe cases being left with one or two ankylosed terminal phalanges. In the very painful cases a splint will give comfort. The case that is established should not have any massage which does not give an immediate beneficial reaction without pain. Passive movements by a masseuse or with the patient's free hand which cause pain are very bad and augment the condition. Hot moist baths for fifteen to thirty minutes with non-painful active movements are excellent. Elevation should be continued high and positive, so that when the limb is depressed to improve circulation, the blood may surge into the capillaries as in Buerger's exercises. Other physical measures I refer to the physiotherapist. When the process permits resisted movements, if these are used in the planes of lost motion, they will be a great aid to the restoration of function. Movements should be given after the hot baths.

Physiotherapy will seldom be needed where the elevation has been adequately carried out from the inception of the original injury; but where the process shows a tendency to develop, and this form of therapy is available, it should be used under the supervision of not only the physiotherapist, but one who understands the lesion. It is a valuable aid in the severe and late

cases, not only for the local comfort, but for the assurance that something is being done during the long convalescence.

Occupational therapy or light work which causes no increase in pain or stiffness is a real aid in the late case where the pain is little and the stiffness great.

A word of caution is necessary in treating the established severe case. The literature contains suggestions regarding treatment of what appears to be analogous conditions; but such treatment is usually applied for some one feature of the whole. As the whole tends to get better with time, my suggestion is to avoid radical measures for any specific changes in a self-limited condition until more definite knowledge exists of the relationship these have to the actual picture. Above all, do not look for any miraculous recovery. The unbelievers may reverse what I have advised against and watch the development of the condition.

Discussion of some views on the relationship of œdema to fibrosis would seem in order. Adami,[2] in the Middleton-Goldsmith lectures, March, 1896, delivered before the New York Pathological Society on "The Relationship Between Inflammation and Sundry Forms of Fibrosis," gives an excellent exposition on the occurrence of overgrowth of connective tissue in the body and theorizes on the causes of such changes in various organs. His views were based on clinical, pathological, and experimental work; and though these lectures were delivered some time ago, they are most interesting in connection with this subject. He defines inflammation: "The series of changes which constitute the local attempt at repair of actual or referred injury." He then states, "Take in the first place chronic obstruction to the flow of lymph, where such obtains whether by pressure of tumors on the main lymph channels of a part, blocking the same, or by diseased states of the lymph glands, it is a matter of frequent observation that *in the absence of satisfactory collateral tracts* the parts become swollen and gradually the fluid swelling gives place to a generalized if not very extreme connective-tissue overgrowth. *In such cases the circulation of the blood through the affected area is maintained.*" (Though he does not state to what degree.) "There are no positive signs of inflammation evident either macroscopically or microscopically. We cannot recognize in the condition an attempt at repair. The primary injury has been at a distance from the region of fibrosis. Nevertheless, it may be argued that the stagnating lymph acts in these cases as an irritant to the connective-tissue cells, and that the condition must be regarded as a productive inflammatory fibrosis." He later states, "Where there is any force in action tending to draw apart, and pull upon the constituents of the tissue, whether the force acts from without or (as in cases of increased effusion of lymph) from within the tissues—when, in short, there is a strain upon the components of the tissue, then, if we regard the work of the connective tissue, as is most plausible as having to bind together and support the other tissues, undoubtedly that work is increased and granting that at the same time the nutrition remains good, we have a condition favorable to increased growth. *A fortiori* we might expect such hypertrophy when simultaneously the amount of nutrition is increased." Matas,[3] in a paper entitled "Surgical Treatment of Elephantiasis and Elephantoid States Dependent upon Chronic Obstruction of Lymphatic and Venous Channels," sums up the requisite etiological factors for producing such conditions as follows:

(1) Mechanical obstruction or blockage of the veins of the region, usually an obstructive thrombophlebitis, or lymphangitis, or adenitis.
(2) Hyperplasia of the collagenous tissue of the hypoderm.
(3) Gradual disappearance of the elastic fibres of the skin.

(4) The existence of a coagulable dropsy or hard lymph œdema.
(5) A chronic reticular lymphangitis caused by secondary and repeated infections of pathogenic microörganisms of the streptococcal type.

It seems rational to believe that in the pathological problem of stiff fingers following an œdema caused by a simple fracture of the forearm, that one might exclude infection entering the picture unless as a distinct focal infection. In such a case, I would be unwilling to believe that the focal infection had any relation to the cause of the lymph stasis. I can readily understand that a focal infection could influence the final joint lesion after it was established, and this may be a cause for the persistence of the process in a small percentage of cases. It is a striking fact that this lesion does not develop in children, from the same degree and duration of stasis, with or without infection, as it does in the adult. In children we have to consider the time period that interrupted lymph channels might take to reëstablish adequate channels to remove œdema and the greater vascularity of the growing child as compared with the adult.

Unquestionably, in the œdema distal to an infection, some or all of Matas' postulates must hold true. This would seem to be substantiated by Homans'[4] work on "Thrombophlebitis of the Lower Extremities," where he gives examples of the overgrowth of connective tissue following prolonged lymph stasis, due to phlegmasia alba dolens, which he calls "post-phlebitic indurations," and ascribes it to lymphatic obstruction rather than venous. He describes the dense fibrous-tissue formation which extends in the subcutaneous tissue down to, but not into the muscles of the leg.

Antedating Homans, Halsted[5] assigned undue tension on the lateral flap in closure of the operative wound following radical mastectomy together with infection as a cause of early swelling of the arm, and recurring infections as a cause of the late swollen arm. He concurs with and gives praise to Matas for the latter's infectious theory of elephantoid states.

Although œdematous arms following radical mastectomy are not infrequently seen as having persisted for long periods, I have never seen a case where the fingers had lost their mobility except by simple distention of the soft parts.

Halsted[6] refers to the work of F. L. Reichert, Mont Reid, and C. Y. Bidegood in replanting a limb in which the femoral artery and vein had become totally obliterated seven months before. These experiments were conducted to determine the amount and duration of the swelling which would follow division of all the lymphatics and veins of the thigh. Swelling occurred but subsided within a ten-day period. Richert[7] showed in the dog, after complete severance of all tissues of the thigh, except the bone, artery, vein, and nerve, followed by resuture, regeneration of lymphatics was demonstrable in four days after operation. The superficial and deep lymph vessels at eight days were physiologically adequate. "Concurrent experiments have shown compensatory arterial and venous regeneration occurs by the third and fourth days respectively. In two to twenty weeks the main lymphatic trunks had frequently united." Swelling lasted up to the tenth day, or a few days more following ligation of the femoral vein and then subsided. Regeneration of lymphatics was delayed by infection or scar tissue.

None of these authorities has reported on the condition of the fibrous tissue in the extreme ends of the limbs; either there was not a disabling overgrowth if any occurred, or attention was not attracted to it. Peri-articular fibrosis in the hand and foot as a sequelæ of a proximal infection would seem to have a strong background, as dependent upon lymphatic stasis.

The cause of peri-articular overgrowth of fibrous tissue following lymph stasis in the non-infected simple fracture I am at a loss to explain.

Clinically, a dependent limb has a greater venous and arterial capillary

pressure. The same limb distended with œdema has relatively a smaller amount of blood in it.

The overgrowth of connective tissue in the hands and feet distal to a proximal trauma may be due to a local attempt to repair an indirect injury, as suggested by Adami, the injury being an unsupported distention of the tissues, the overgrowth being stimulated by either a superabundance of normal lymph or a changed lymph due to temporary physiologically incompetent lymph channels in the presence of a diminished vascularity, as is observed in the hypertrophied scar.

The fact that the lesion is prevented by elevation suggests that lymph stasis sufficient to promote fibrous tissue overgrowth is avoided until the lymphatic and vascular injury has had time to regenerate and become physiologically adequate.

This hypothesis merely affords a principle for preventive treatment, but does not satisfactorily show the true cause, nor does it furnish a suggestion for the treatment of the established process.

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THE STUMP OF THE APPENDIX, AN AGENT OF INFECTION

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For practical purposes appendectomy should never be considered clean surgery for the reason that the mucous membrane of the stump of the appendix is part and parcel of that of the colon which in surgical parlance is proverbial for its infectivity. The menace is further increased by a devitalization of the stump from crushing, cautery and ligation. In the discussion of the unchanging mortality of appendicitis this factor seems to have been ignored, and improvement in this regard requires a revision of some of our cherished convictions. There is no operation in surgery that offers so many unexpected infections as that of appendectomy, and as a result the operating-room supervisor and sterilizing equipment are at times arraigned unjustly for supposed breach of aseptic technic in which accusation surgical conscience seems to rest.

A pathological study as to the type of infection of the mucous membrane in question has little practical bearing on the fact of infection which must be accepted as a challenge to ascertain the modifying factors. While such residual infection cannot be annihilated, there can be brought to bear certain methods for conserving such infections.

Pioneer surgeons thought it very important to peritonealize the stump by dissecting off a cuff to cover same, but trauma and infectivity soon became in evidence. Inversion without ligation was then tried but hæmorrhages became too frequent. Following this experience ligation and infolding of the stump was adopted and is still a popular method with many good surgeons. The "open drop" method, however, seems to be the choice of a majority of surgeons and escapes the occasional menace of pent-up virulence and invites an open early and gradual fight with the remarkable conservative powers of the peritoneum. Unexplained post-operative temperatures are frequently an evidence of this process. Initial infections are as a rule comparatively mild when compared with the virulence developed within a few days, especially when the infolding method was adopted. As such pent-up infection cannot be discharged into the colon, it must burst into an unguarded peritoneum which has not had time to build up protective adhesions. Operative findings warrant the belief that in the observations of infection, virulence can be judged not so much by gross appearances as by the duration of infective processes for the peritoneum can fortify itself against a great degree of infective activity if given sufficient time to build such fortifications. It has been observed that synergized infections in the peritoneum develop a greater degree of virulence than follows a more simple type and the time element becomes an intensifying factor.

When we bear in mind these considerations, one method of treating the stump is about as good as another provided it is handled with meticulous care in avoiding contamination. Our rule has been to use iodine after ligation and excision and swab out the lumen of the stump and then apply a taped sponge and return the cæcum to its original position where it remains until the peritoneal sutures are well-nigh completed.

Primary infections of the layers of the abdominal wall are rarely serious and only become so secondarily from deeper infections and according to Schumann, in the presence of modern aseptic technic, practically all unexpected serious infections proceed from within. Quoting from Herman[1] the resistance of the peritoneum to infection is three or four times that of the skin and layers of the abdominal wall.

It is not a radical policy for every case of appendectomy to be treated for two or three days as peritonitis for such is the case in miniature. Such treatment is no harm to the case that would recover without it, and the treatment may be summarized: morphine and great restriction of fluids by mouth which reduce the peristaltic wave to a minimum. That means negligible vomiting and tympany which tends to aggravate border-line infections. The bugbear of acidosis frightens many surgeons into the menace of meddlesome post-operative treatment for acidosis *per se*, like fever, has little significance aside from its etiology and in the absence of active infection rarely follows the restriction of fluids by mouth. Any use of purgatives before the end of the third day is likely to defeat the effort for immobilizing the peristaltic waves, for within this period of time the fate of these early infective processes will have been determined. The free use of fluids by mouth and any kind of purgations in the first two or three days defeat the object for which they are given and instead of preventing acidosis such efforts invoke a toxic element through stagnation so that less water is finally metabolized.

Our own statistics[2] show that the mortality rate for females (2.7 per cent.) is 1 per cent. less than that of males (3.7 per cent.) and this difference is probably due to the fact that the peritoneum of the female is more resistant to infection because more inured to the absorption of bloody fluids incident to menstrual cycle.

ACUTE APPENDICITIS

	Total		Non-Resident		Within 24 Hours		Closed Incision		Drainage	
	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths
Harbin Hospital 1911–1931	1080	31	669	27	336	0	669	1	411	30
		2.8%	62%	4%	31%		62%	.01%	38%	7.3%
Eight Atlanta Hospitals 1927–1931	4270	188	388	16	1827	30	3411	129	809	59
		4.4%	9%	4%	42%	1.6%	82%	3.7%	18%	7.3%

The ever-present potential infection in the stump of acute and chronic appendicitis at times becomes activated through unavoidable surgical trauma and this hazard should have due consideration more especially in the post-cæcal type.

The perennial question of drainage in acute appendicitis, like Banquo's ghost, still confronts us and is treated by many surgeons as a closed issue and by others as a matter of personal taste and by all as an insult to surgical pride. Such an attitude of surgical practice requires critical analysis in a larger field of study in which any one man's observations cannot be final. With this in view we have compiled statistics of acute appendicitis of many operators in standard hospitals.[3] The question of drainage can in my opinion be better settled by a study of mortality rates of closed incisions. In this table two important differences may be noted. First cases of operations within the first twenty-four hours 336 (with 12 per cent. drainage) with zero mortality in the one and 1,827 cases in the other with a mortality rate of 1.7 per cent. Second a smaller rate (62 per cent.) of closed incisions with a mortality rate of 0.01 per cent. in the one and a rate of 82 per cent. and mortality rate of 3.7 per cent. in the other. It is reasonable to believe that the differences in this comparison hinges to a great extent on the different viewpoints of dealing with the appendiceal stump. So in these standard hospitals it is fair to conclude that the drainage and mortality rates maintain somewhat of an inverse ratio.

The pioneer surgeons were wont to either close the incision or else leave it entirely open without sutures using glass or solid rubber tubes with a superficial pack. This was rather an ultra-safe technic so far as drainage was concerned, but post-operative hernia was frequently in evidence. A valuable compromise between these two extremes developed in the use of fenestrated rubber tissue tube (without gauze) drainage with closure of incision to the angle, and this technic incurs no mechanical obstacle to peristalsis and a great degree of capillary drainage is furnished by flat surface in the presence of intra-abdominal pressure. In every suspicious case the pelvis should be searched for pocketed serum pus accumulations. This rubber tissue tube should be a third longer than the distance to the stump then the tube will not be shortened by deflection from the peristaltic wave and distended coils of intestines. I belong to the school of surgeons who still believe in draining when in doubt. This rule enables one to observe a minority of cases of drainage without harm in border-line cases that prove to have been unnecessary as evidenced by a scanty discharge and in many instances checked as sterile and I do not believe that such drainage makes infection but rather accentuates a latent type that promptly becomes disposed of. However, in the majority of cases of drainage of border-line infections, there is a profuse serous discharge in evidence that is unquestionably not due to the presence of a rubber tissue tube. In every surgical repair within the peritoneum there is poured out more or less serous effusion which would ordinarily be absorbed unless some potential infection becomes provoked, and

the first stage of preventing such infection would be to remove the pabulum upon which potential infectivity would thrive. While many such frank infections readily localize and discharge spontaneously through the incision they do so with greater degree of average morbidity and damage to the strength of the abdominal wall than would follow primary drainage to the stump of the appendix. It is needless to urge that a superficial drainage could not necessarily prevent a pocketed or spreading infection around the stump and of course it would be useless to drain in the presence of an enfolded stump.

SUMMARY

(1) For practical purposes an appendectomy should never be regarded as clean surgery.

(2) Potential infection subsists in every treated and devitalized stump of the appendix.

(3) The "open drop" method, safeguarded temporarily by a small, taped sponge, avoids pent-up virulence of infection and promotes an early open fight with the conservative processes of the peritoneum.

(4) Drainage when in doubt will conserve directly and indirectly a great degree of average morbidity and occasionally prevent a death that would otherwise occur in a closed incision.

(5) The rubber tissue tube drainage tube without gauze to the focus creates a negligible interference with the peristaltic wave.

(6) The conservative processes of the peritoneum are facilitated by efforts at indirect immobilization of peristalsis by reducing the oral intake of fluids to a minimum along with morphine for the first three days.

(7) In well-organized clinics comparative statistics by the thousand cases showed that in one series the rule of drainage, when in doubt, was adopted with a drainage rate of 38 per cent., with a total death rate of 2.8 per cent., while in other clinics with a drainage rate of 18 per cent. there was a death rate of 4.4 per cent.

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DRAINAGE AFTER OPERATION FOR APPENDICITIS

CHIEFLY ON THE REMOVAL OF DRAINS

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The question of drainage in appendicitis is still not sufficiently settled so that the procedure can be said to have become standardized. Each surgeon thinks that his method of drainage is the correct one. When I read an article by Dr. F. C. Warnshuis[1] on appendicitis, I was made to think that perhaps my method of removal of drains is wrong. He stated that the drains must not be removed until they are ready to float out almost by themselves. Deaver[2] also says that the drain should stay until it falls out. Many other surgeons follow this procedure at the present time, but usage does not necessarily mean that the method is correct or advisable.

We were taught (Cornell '08) that a sinus or tract was formed about a drain in four hours. When I was an interne at Presbyterian Hospital, 1908 to 1910, drains were removed very gradually, a little each day. The sinuses which followed this method of removal frequently needed irrigation; the care which they demanded forced me to wonder why we were taught that four hours were sufficient for the establishment of a drainage tract, and why we practised as we did. I also saw fæcal fistulas following the method then in use. If our teaching were correct, the method could be changed, and much hard work could be saved. When I was house surgeon, I made this change and have followed a fairly consistent method of handling drainage for twenty-two years.

As a rule the type of drainage has consisted of a split rubber tube with an iodoform gauze strip inside inserted to the pelvis, and a cigarette drain with an iodoform gauze centre inserted either to the abscess cavity or to the site of the appendix. If the cavities were well walled off, the drains were inserted into the cavities only. Variations from this technic have consisted in two tubes, or two tubes and a cigarette drain, or occasionally three cigarette drains; but by far the greatest number of cases received one tube and one cigarette drain. I give this much about the type of drainage used so that my discussion of the removal of the drains will be understood. While I think that the type of drains used is of only minor importance, I do feel that two drains are better than one.

My chief concern, however, is in the removal of the drain. I have always removed the tube early, either on the day after the operation, or on the second day after the operation, according to whim, as I had no good reason for first-day removal except that it more nearly adhered to what I had been taught. I remove the cigarette drain two or three days after the removal of the tube drain, generally two days. When there was profuse drainage, I

left the cigarette drain in until there was only a small patch of thin discharge, about two inches in diameter, on the dressing; but as a rule the discharge diminished to an area of this size by the second, or third, or fourth day. In a series of 951 cases, 229 were drained. Drains were removed as follows: first day twelve, second day 141, third day fifty-four, fourth day sixty-nine, fifth day twenty-one, sixth day twenty-one, seventh day five, more than seven days two. There was no record of the removal time in five cases. Only forty-nine drains were removed after the fourth day, while 276 drains were removed before the fifth day. It may be feared that the early removal of drains may lead to more secondary abscesses, but I have not found this to be the case.

I have noticed that muscles once separated by drains do not close tightly quickly after the removal of the drains. As a consequence, any retained secretions have been readily evacuated by turning the patient face down, or by a clamp, or the little finger inserted into the wound. Occasionally a secondary abscess has occurred in the pelvis. I have had this happen twenty-eight times. Fourteen times I drained the abscess by an incision into it through the rectum and the insertion of an umbrella tube drain for a few days with only a slight prolongation of convalescence and no disturbance of the abdominal wound. Fourteen times I drained the abscess abdominally either through the original wound or through a separate incision, but generally through the original wound. Furthermore, I have not had to trouble with sinuses as I did when I was an interne. There have been no fæcal fistulas. My mortality of 3.36 per cent. compares favorably with those of men who remove drains much more gradually. A few figures showing some results of the late removal of drains may be interesting. Deaver[3] reported 256 cases with fourteen cases of fæcal fistulas; in another series of one hundred cases, there were five fæcal fistulas; in a third series of 1,700 cases[4] there were seventy-six fæcal fistulas with ten deaths or 14.7 per cent. Of this last group, 2.8 per cent. required secondary operation with 16.6 per cent. deaths.

Although fæcal fistulas are undesirable, they are only complications. The chief test for the early removal of drains is mortality, and here is what my records show. There were thirty-two deaths. Five had no drainage, but two of these, which were general peritonitis cases, should have had; at least, I felt that way after their deaths. Twenty-seven had drains as follows: tubes alone, three cases, one of which had three tubes, a second of which had two tubes, and the third of which had one tube. Tubes and cigarette drains, twenty cases: three of those had one tube and two cigarette drains, two had two tubes and a cigarette drain, and one had one each of the tube and cigarette drains in two separate cuts. There were only three cases which had cigarette drains only. One case died on the table from spinal anæsthesia as a tube and a cigarette drain were being inserted. This left twenty-six cases which lived for awhile with drains in. Of these twenty-six cases, seventeen died while drains were still present in the wound. Nine

cases died after the drains had been removed; and the records of the causes of death in these cases are as follows: One died seven weeks after operation of multiple abscesses in the mesenteric glands. At the second operation the peritoneum was smooth and shiny and had thoroughly recovered from the primary peritonitis.

One died on the ninth day after operation from multiple emboli from thrombosed femoral vessels, as shown by autopsy.

One died of starvation over five months after the operation because she wanted to die and refused to eat or to receive medical aid. She had been fully recovered for five months from general peritonitis and four months from a secondary subphrenic abscess which had been drained, and from pleurisy with effusion which had been relieved by aspiration.

One died on the seventeenth day, two days after a secondary pelvic abscess had been opened abdominally. The cause of death in this case was acute intestinal obstruction of six hours' duration. Death occurred two hours after the operation for the last condition.

One died a few hours after the drain had been removed on the fifth day. The temperature had been 103° and 104° throughout, but the patient appeared to be in good condition, and there was very little drainage. She was comfortable, and the abdomen was soft. An enema was followed by collapse, distention, and death.

One died just after the last drain was removed, but she was very near death at the time of the removal of the drain.

One died on the sixth day, and the drain was out on the fourth day.

There were two cases in which I have no record of removal of the drain. Autopsy in one showed that the peritoneum had fully recovered from the inflammatory reaction. The patient evidently had died of exhaustion. He had been sick twelve days before the operation and entered the hospital with a temperature of 107° and died on the sixth day after operation, after the temperature had shown a gradual decline to 100°.

The other case of which I have no record of the date of removal of the drain died on the thirteenth day while sitting up. He collapsed and died a few hours later. This death was probably caused by an embolism.

I have gone rather fully into the nine deaths in which drains had been removed, so that others may decide if early removal of the drains had anything to do with their deaths. As for me, I feel that the seventeen deaths with drains still present sufficiently counterbalance any argument which might be advanced to show that the early removal of the drains in three of the nine cases might have influenced the outcome. In the other six cases I feel that there can be no question about the fact that the lack of drains did not cause the deaths.

So long as my results have been no worse than they have been, and with no fæcal fistulas to report, I feel justified in my conclusion that the early removal of drains is sound and that prolonged drainage is unnecessary as well as troublesome.

APPENDICOSTOMY IN CASES OF RUPTURED APPENDIX ASSOCIATED WITH DIFFUSE GENERAL PERITONITIS

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The mortality in instances of acutely ruptured appendix accompanied by diffuse general peritonitis is extremely high under methods of treatment commonly employed. Such experienced surgeons as Lynch, Deaver, and Ashhurst report death rates as 57 per cent. The purpose of this paper is to consider the problems presented by this type of appendicitis and to describe a mode of management employed by the writer which has proved highly useful in his clinic and in the hands of other surgeons.

Surgeons commonly have observed that in acute abdominal lesions, particularly appendicitis, patients who develop fecal fistulæ accompanied by diffuse peritonitis usually recover provided there is not too much interference.

If fecal fistulæ do *not* develop, the convalescence is prolonged, stormy, and is complicated by great abdominal restlessness, severe pain, and marked prostration.

In 1924, in a patient who had an acutely ruptured appendix accompanied by diffuse general peritonitis, I treated the condition by appendicostomy. Recovery was rapid and uneventful; the patient was able to leave the hospital in fourteen days. There was no anxious period due to abdominal distention, septic intoxication, or severe pain. Since this successful termination, in which I first introduced appendicostomy to meet the condition, I have invariably employed appendicostomy in the management of acute appendicitis when complicated by rupture and peritonitis. A series of seventy-five patients, with a mortality of but 1.4 per cent., would appear to justify the procedure. It has been of considerable satisfaction to observe that Wilkie, of Edinburgh, to whom I described my procedure in 1926, and Gatch, of Indiana, with whom I discussed it in 1928, have had experiences comparable with my own. Wilson, of Emporia, employed a somewhat similar method and likewise reports excellent results.

It is not necessary to detail here all of the symptoms and the physical findings when an acutely ruptured appendix has become complicated by diffuse peritonitis. I wish to emphasize, however, a few points which I consider cardinal.

In this condition, one early observes marked abdominal distention and muscular rigidity. Frequently, there are vomiting, pain and restlessness. Severe toxæmia rapidly develops. The severity of the symptoms and signs is in direct proportion to the time-interval following perforation. While the leucocyte count and polymorphonuclear cell-ratio may be low at first, subse-

quent increase is rapid. Blood chlorides decrease and urea nitrogen increases in accordance with the degree of intestinal distention and the body fluid loss by vomiting. This phenomenon has been emphasized by Gatch and by Dragsted in experimentally produced and clinically occurring acute intestinal obstruction, ileus, or peritonitis.

In my series of patients the blood-chloride decrease ranges from 100 to 200 grams. As infection progresses and spreads, the intestine becomes progressively distended. With this increasing distention, the arterial blood supply to the intestine mechanically is interfered with. It has been shown that the duodenal and jejunal capillaries collapse when an intra-intestinal pressure of thirty-five to forty-five millimetres has been reached; the capillaries of the ileum withstand a considerably higher degree of pressure. The result of this closure of the arterial capillaries is ischæmia, and death of the gut on its antimesenteric border quickly follows. It is not unusual to have infective thrombosis occur, and then extensive infarction follows. In such circumstances, blood chlorides fall rapidly, and death ensues in a manner similar to that observed in acute intestinal obstruction.

To Wayne Babcock we are indebted for evidence showing that the normal peritoneum has a great capacity for absorbing large quantities of fluids. When peritonitis is present, however, this capacity for absorption is reduced about 95 per cent. An active defensive mechanism is then initiated, namely: limitation to the absorption of toxins. If this defense mechanism is not disturbed, as by peristaltic activity, and by poor blood supply, and, if the source of infection can be removed, the peritoneum is in position to take care of the infection by which it is actually involved.

In order to obtain the most favorable results in the management of acutely ruptured appendicitis, complicated by peritonitis, it is necessary to appreciate the actual anatomical, physiological and chemical mechanism being exhibited, intra-abdominally, and, so far as possible, not to interfere with it. The operation of appendicostomy rationally meets conditions and in no way interferes with the series of protective measures instituted by nature.

Appendicostomy drains the cæcum and the ascending colon directly. When the pressure is thus removed from the ileocecal valve, relaxation occurs. This is progressively facilitated as gas and contents of the small bowel move outward through the appendicostomy tube. It follows that the intestines are placed at rest, the demands for peristalsis are slight or nil, there is no distention, the blood supply tends to become normal as interference with capillary circulation is relieved. As peristaltic activity decreases the patient becomes comfortable and is able to secure needed rest. By the operation of appendicostomy obstructive adhesions rarely occur, provided there has not been rupture of the continuity of the endothelial cells from prolonged intestinal distention. In fact, the peritoneal exudate is, in itself, a protective force against the development of adhesions. Physiologists have demonstrated that the body absorbs about 65 per cent. of its fluids and chlorides from the colon. Following appendicostomy the introduction of fluids and chlorides through the

appendicostomy tube prevents acute, systemic dehydration and rapid and serious chloride loss.

My technic of appendicostomy in the management of acutely ruptured appendix with peritonitis is as follows:

The abdomen is opened either by right rectus, or the muscle-separating technic of McBurney. The appendix is identified and removed. (This we

FIG. 1.—Appendix exposed; ready purse-string suture at base and the introduction of rubber tube through stump.

always do in order to get rid of the infective nidus.) (Fig. 1.) Through the appendiceal stump a No. 16 F catheter or rubber tube is inserted. (Fig. 2.) Having first been passed through the omentum, a No. 1 plain catgut suture is placed through both the appendix stump and the rubber tube and tied. A purse-string suture of catgut or silk is next inserted around the appendiceal

base; the appendiceal stump and tube are inverted into the cæcum and the purse string tied. (Fig. 3 and insert.)

The omentum is made to serve two purposes by the procedure; it separates the cæcum from the abdominal wound, and prevents fecal leakage when the tube comes out. The tube is then brought through a stab wound, or through

FIG. 2.—Appendix removed; rubber tube secured in stump. Inset shows intracecal protrusion of inverted stump and tube.

the original incision. (Fig. 4.) The primary wound is then closed either with or without drainage. However, I generally prefer to insert a rubber-dam drain into the pelvis and one in the region of the hepatic flexure of the colon. (Fig. 5.)

The wound is then closed in the usual manner. A non-absorbable suture

is inserted through the skin and the tube, to prevent the tube being pulled out by accident. (Fig. 5 and insert.)

Post-operative Care.—On being returned to bed the patient is immediately given 1,000 cubic centimetres warm normal saline hypodermoclysis. This may be repeated in six hours. The appendicostomy tube is left open for six hours;

FIG. 3.—The inverted stump with tube as finally secured in place.

at that time 200 to 300 cubic centimetres warm normal saline solution (depending on the size of the patient) are instilled into the cæcum through the appendicostomy tube. After instilling this solution, the tube is clamped for thirty minutes. The clamp then is removed and the tube remains open one and one-half hours. This procedure is repeated every two hours. The strength of the saline solution may be varied in accordance with the concentration

of chloride in the blood. We have employed as high as 5 per cent. saline solutions. However, if greater than 2 per cent., there is a tendency to cause diarrhœa. An adult patient can readily absorb as much as three litres of saline solution from the colon in twenty-four hours.

Without exception, nothing is given by mouth for forty-eight hours; this fasting period may be prolonged to seventy-two or ninety-six hours, according to the condition of the patient. In some cases we have waited five days before anything has been given *per os*. Fluids are absorbed from the colon in such large quantities that when given by way of the appendicostomy tube alone, normal kidney function is possible, the patient's tongue and skin

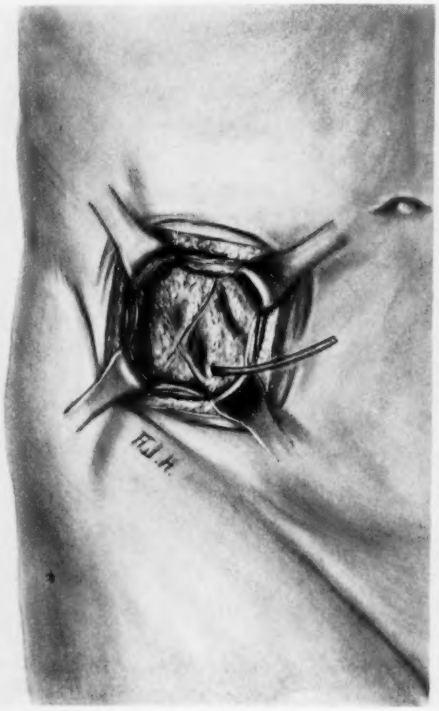

FIG. 4.—The rubber drain tube brought out through the primary incision.

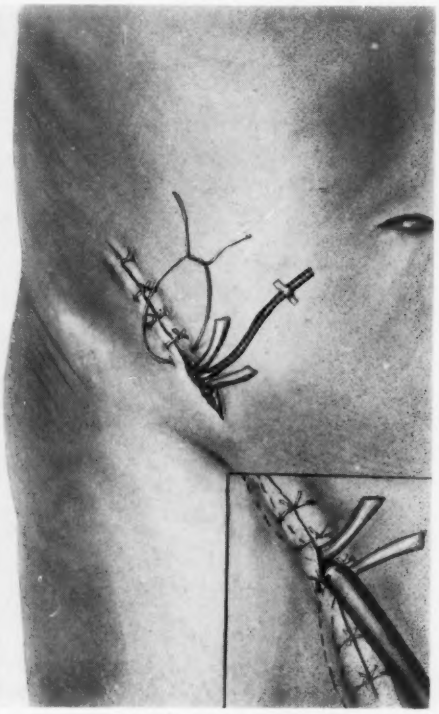

FIG. 5.—Drains placed; wound closed. Non-aborbable suture through skin and tube shown in insert.

remain moist, and he is comfortable. Should thirst become troublesome, a moist sponge to the lips, or the chewing of gum or wax (Smithies) gives relief. When fluids are started *per os*, we routinely give one dram of water every one or two hours. The quantity is increased accordingly as it is tolerated. Nutrient fluids also are administered as soon as it is found that water is well tolerated. Smithies' suggestion that raw milk be omitted is a valuable one. If milk is given it should be citrated (gr. 1 sodium citrate to the oz.), or parboiled, cooled and then flavored to suit the taste. Flavored cereal gruels carry high nutritional value, and usually are well borne. The vitamine demand is met by the employment of fruit juices, and the juices of tomato, sauerkraut, meats, clams, *etc.*

The suture through the skin and tube is usually removed about the sixth or the seventh day, and the tube is permitted to come out spontaneously. We have never had a fecal fistula occur after the tube has been removed when appendicostomy is performed as above described.

Morphine is rarely needed except during the first forty-eight hours, when the patient is restless, or sleeps with difficulty. It is then administered only in small doses.

When shock is great and the peripheral circulation is markedly depressed, morphine, adrenalin, and other drugs often are ineffective, when given subcutaneously, because they are not readily absorbed. Under these circumstances, medication becomes efficacious if given intravenously (Smithies). The dosage by this route should be approximately one-half that commonly administered subcutaneously.

Glucose solution, milk, and other fluids are not introduced through the appendicostomy tube. They are not completely absorbed (probably the water only) and may do harm from acting as culture media for bacteria.

Our mortality rate in seventy consecutive cases has been 1.43 per cent. With other types of operation, and other methods of treatment, the reported mortality frequently has been as high as 57 per cent. Our average period of hospitalization has been eighteen days. The types of infection in our series have been *B. coli, Welchii*, and in a few instances, streptococci.

We have performed appendicostomies on many other types of appendicitis, in order to prevent anticipated post-operative distention.

The following CASE REPORTS are typical illustrations of the material with which we have to deal:

CASE I.—J. F., male, laborer, aged twenty-six years. Admitted to the hospital February 2, 1924. Pain in the right side for two days; very sharp pain fifteen hours previous, then felt some better for a time. Abdomen distended and very rigid; tender; pulse, rapid; vomiting; temperature, 102° F.; leucocyte count, 25,800; polymorphonuclears, 87 per cent.

Operation.—McBurney's incision. Appendix ruptured about middle; general peritonitis; large amount of free fluid and no attempt at walling off or localization. Appendicostomy performed; a rubber dam drain to pelvis. Five days later (February 7) saline instillation through appendicostomy tube discontinued. February 9, 1924, tube came out. Patient was discharged February 16, (fourteen days after operation); returned to work four weeks from date of operation.

CASE II.—J. H., male, aged thirty-six years. Admitted to the hospital July 17, 1925. First appendicitis attack, 1918; several attacks since. Forty-eight hours ago began with severe pain over entire abdomen, vomiting and prostration; pain became localized over right lower quadrant. Abdomen tense and very tender, tympanites marked; borborygmus present. Leucocytes, 15,300; polymorphonuclears, 87 per cent.; urine, albumin 1 plus. Blood chlorides, 300 mgm.

Operation.—Ruptured appendix, general peritonitis, with no attempt at walling off. Appendicostomy with rubber dam drain to liver and pelvis. Distention down within twenty-four hours; temperature, 101°, on two occasions, eighteen and thirty-six hours after operation. Catheter came out on sixth day. Patient discharged August 4, 1925, eighteen days after admission.

CASE III.—J. H., male, laborer, twenty-three years old. Entered hospital October

15, 1928. Patient was told by two doctors five days ago he had a ruptured appendix, but refused to go to hospital. Abdomen very tense, patient in shock and condition desperate. Pulse, 140; temperature, 101°; leucocytes, 23,200; polymorphnuclears, 89 per cent.

Operation.—Large ruptured appendix, general peritonitis, with thick exudate. No localized abscess could be demonstrated. Appendicostomy, with drains to spleen, liver, left lower quadrant, and pelvis. Patient improved and condition seemed very good. October 21 at 9:00 A. M. the tube came out. The abdomen immediately began to distend, patient became restless. At 11:00 A. M. the tube was inserted through original opening, distention disappeared and patient immediately improved. October 23, A. M., the tube again came out, but I was not notified until 6 P. M. Patient's condition was bad. Unable to re-insert the tube. Distention was marked. Jejunostomy performed. The patient expired at 8:10 P. M., October 23, 1928.

CASE IV.—E. M., female, secretary, nineteen years old. Admitted to hospital June 4, 1929. Severe dysmenorrhœa since puberty. June 1, 1929, just finished menses, began with severe pain in right side accompanied by rigidity. Her condition became much worse, and she was referred June 4, 1929. Abdomen distended, marked rigidity, and very tender; tympanites; "silent" abdomen. Leucocytes, 28,800; polymorphonuclears, 89 per cent.

Operation.—There was a fecolith at the appendix base, size of a cherry stone; appendix ruptured at tip. Pus was distributed over entire abdomen. There was no attempt at walling off. The gut was greatly distended and blanched, the blood-vessels being almost collapsed. Appendicostomy performed; drain tubes to liver, left hypochondriac area and pelvis. A very stormy convalescence; severe tonsillitis five days post-operative, with cervical adenitis and parotitis. Patent became delirious, cyanotic, *etc.*, and exodus was expected momentarily. The appendicostomy tube came out June 13, 1929; condition became worse; the tube was re-inserted and kept in place two more weeks. Culture showed streptococcus. Patient was discharged August 13, 1929; has been perfectly well since.

CASE V.—D. C., male, aged three years. Admitted May 11, 1930. Mother had noticed for past week child has not felt well, appetite poor, restless and complained of pain in abdomen; past three days child would not eat; suddenly developed a severe pain in abdomen. Abdomen greatly distended; extremely tender over entire abdomen, possibly more pronounced over right lower quadrant. No palpable masses. Stool has not contained any bloody mucus. Rectal examination not made.

Operation.—May 11, 1930, muscle-separating incision. Appendix gangrenous at distal end, perforated one inch from tip. Free seropurulent fluid throughout entire abdomen. No attempt made at localization. Appendicostomy and Penrose drain to pelvis and rubber tube to liver. Wound closed as in Fig. 5. Hypodermoclysis 500 cubic centimetres six hours. 150 cubic centimetres normal saline instilled through tube clamped one-half hour, open one and one-half hours. This was repeated every two hours. May 12, 1930, water one-half dram by mouth every two hours. May 17, 1930, appendicostomy tube came out. Patient discharged May 24, 1930, thirteen days after admission. Has been perfectly well since.

CASE VI.—M. H., female, aged seventy-seven years. Admitted to hospital May 28, 1930. For three days pain in abdomen which was more or less localized. Later it localized in lower right quadrant and has been accompanied by very severe nausea and vomiting.

Operation.—May 28, 1930, right rectus incision under novocaine. An adherent, gangrenous, ruptured appendix removed. Free fluid throughout entire abdomen; no localization. Cultures demonstrated colon-bacillus infection. Appendicostomy performed, rubber dam drains to liver and pelvis. Wound closed in usual manner. Hypodermoclysis, 1,000 cubic centimetres on retiring to bed. 300 cubic centimetres normal

saline through tube after six hours; then every two hours. June 2, 1930, five days after operation instillation through appendicostomy tube discontinued. Tube came out June 4, 1930. Drainage quite profuse due to *B. coli* infection; no post-operative distention; patient comfortable. Temperature, 101° on admission; May 29, 99.8°; May 30, 99.6°; from then on temperature normal. Patient discharged June 28, 1930; wound healed.

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DIFFERENTIAL DIAGNOSIS OF ABDOMINAL MANIFESTATIONS OF ACUTE RHEUMATIC FEVER FROM ACUTE APPENDICITIS

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Various abdominal manifestations of acute rheumatic fever have been recorded during the past three hundred years. In fact, in the seventeenth and eighteenth centuries obscure digestive disturbances were explained on a hypothetical rheumatic diastasis in the patient. Interest, however, in this symptom complex had largely subsided prior to 1880, when Lambin[1] expressed the possible localization of acute rheumatic fever anywhere in the gastro-intestinal tract with "predilection for the intestine."

Grant[2] reported in 1893, before the New York Medical Society, two cases of acute rheumatic fever in children with the onset by acute low abdominal pain, fever and localized abdominal tenderness and muscle resistance in the right lower quadrant. These abdominal manifestations subsided in three days with the appearance of polyarticular rheumatism. Two years later, Brazil[3] recorded similar observations in two patients, onset of abdominal pain and localized tenderness in the right lower quadrant followed by typical polyarticular rheumatism. Both these authors comment on the possible association of rheumatism with appendiceal inflammation.

During the past thirty years, reports of isolated cases of rheumatic fever simulating appendicitis have appeared in the literature; and with the general acceptance of early intervention for acute appendicitis, many of these cases have been submitted to operation. With few exceptions, the extra-appendiceal nature of the pathology was noted immediately at operation with only a few cases of peritoneal irritation distant from the appendix recorded. The accumulation of pathological material during the past ten years has become sufficient to allow some analysis in changes of the appendix in reference to these phenomena.

There is evidence in occasional instances of a true peritonitis as supported by Wood and Eliason,[4] who noted increase of clear abdominal fluid and signs of peritoneal irritation in the right upper quadrant although the appendix was normal. They collected several cases from the literature which were similar in nature. Recently Paul[5] has reported a fatal case of acute rheumatic fever with localized diaphragmatic peritonitis of a true rheumatic nature although ante-mortem abdominal symptoms were absent. Poynton[6] has also found, in fatal cases, peritonitis around the liver and spleen. However, the infrequency of true peritonitis is attested by Rolly, who found evidence of such in only two cases of 3,500 suffering from rheumatic fever.

M. Feure[9] finds rare but incontestable evidence that rheumatic fever may start with peritoneal inflammation.

The appendix, however, has not been observed to be involved even in the rare cases of peritonitis. At operation its appearance is normal with occasional histological changes consistent with earlier mild inflammation. Poynton has never found acute changes in the appendix in fatal cases of acute rheumatic fever. Tallerman[7] observed two cases with signs and symptoms pointing to the right lower quadrant. The appendix was found to be normal at operation and joint symptoms appeared two days later; likewise Auvray[8] noted a case with acute abdominal symptoms while at operation only a questionable chronic process in the appendix was found. Bernard[10] also reported a case simulating appendicitis in symptomatology but at operation the appendix was found normal with œdema of the tissues of the latero-colic gutter. Articular symptoms were first noted four days after operation. Costedoat,[11] operating on a case of this nature, found nothing intra-abdominal whatever. He favors reference of pain from the pleura as an explanation of the symptoms rather than a true peritoneal irritation.

There are reported a certain number of cases with symptoms pointing earlier to acute inflammation in the right iliac fossa who, being held under observation because of "tachycardia and distant heart sounds,"[12] developed polyarticular symptoms the following day. Moffat[13] likewise noted two unoperated cases whose abdominal symptoms cleared up spontaneously and completely with the appearance of articular symptoms. Auvray[8] has further noted a case with a normal appendix at operation who had return of the abdominal symptoms three days post-operatively, at which time joint lesions appeared and the heart was definitely affected.

The similarity in onset of atypical forms of these diseases with the inadvisability of operation in acute rheumatic fever has awakened new interest in an endeavor to establish the differential diagnosis between acute suppuration of the appendix and pseudo-appendiceal syndromes of acute rheumatic fever.

A review of the 160 cases of acute rheumatic fever admitted to the Strong Memorial and Rochester Municipal Hospitals during the past six years reveals eight patients in whom a syndrome simulating acute appendicitis in some stage was present without proved inflammation of the appendix. Two cases with acute rheumatic fever developed acute suppurative appendicitis proved at operation. Exploration of the abdomen and appendectomy was performed on four of the other patients. The remaining four, although admitted to the surgical emergency with complaint of abdominal pain and tenderness, were held under observation because of lack of signs substantiating a diagnosis of acute appendicitis. These patients subsequently followed a typical course of acute rheumatic fever. The four cases submitted to operation were as follows:

Case I.—C. C., SMH No. 48,032, male, white, aged ten years, was admitted June 3, 1931, with complaint of abdominal pain. Four days before admission he had first noted

dull pain in the right side of the abdomen after jumping; the following day his throat became sore, and two days later the abdominal pain which had been constant became more severe and localized about the umbilicus. He was feverish, had nausea without vomiting. Castor oil and magnesia were administered without results. On the day of admission, the pain radiated toward the right inguinal ring.

The past history revealed uncomplicated measles at four years. One year ago routine examination showed normal findings. On one occasion, a sore throat with tender cervical glands was noted. Otherwise he was considered extremely healthy.

Family history revealed no familial diathesis or chronic diseases.

Physical examination showed a moderately ill, feverish boy. His temperature was 38.4°, the pulse 110 and respiration 20. The tonsils were large, injected, and there were tender cervical glands. The heart and lungs showed no abnormal signs. The abdomen was held in spasm in the right lower quadrant but his maximum spontaneous pain was at the umbilicus; this was exaggerated on inspiration. Tenderness to palpation was maximum at McBurney's point with pain on release only at this point. Percussion pain was localized in the right lower quadrant with pain referred from pressure in the left lower quadrant to the right. There was rectal tenderness bilaterally without induration. Leucocytic count, 13,300. Urine was negative. Throat culture was negative for K.L.

Pre-operative diagnosis was acute appenditicis.

Appendectomy was performed immediately, no free abdominal fluid was present but old adhesions causing kinking in the middle with no sign of inflammation of the appendix.

Post-operative Course.—Temperature was 39° to 40° C. on the first two days, pulse 100–110, and respiration 20–30. Pain in the left ankle was noted on the first day post-operative, right ankle was swollen and tender the following day with pain in both knees. At this time systolic murmur was heard in precordium but no enlargement of the heart by percussion was found. The abdomen was soft, not distended, leucocytic count 6,000. The temperature descended by lysis to normal on the seventh day, and the pulse remained at 70 from that day on. The abdominal wound healed without suppuration. Salicylates were administered with satisfactory results.

Microscopical section of the appendix showed lymphoid hyperplasia with thickened submucosa and serosa. There was no acute inflammation present. Cross-section of a round worm was seen in the lumen. Culture from the right iliac fossa showed no growth. Convalescence was protracted but uneventful.

Case II.—F. N., SMH No. 31,024, male, aged fourteen years, white, was admitted January 3, 1930, with a complaint of abdominal pain.

Onset of present illness was three days before admission with sore throat, pain in legs and knees. The same day abdominal pain arising at the right costal margin anteriorly was noted; it soon localized in the right lower quadrant where it remained until admission. Frequent chilly sensations were present at onset with nausea but no vomiting. Cathartic was taken with watery evacuation and the day before admission, resistance of abdominal muscles was noted. The patient fell while coasting a week before admission, abrasing the right groin and spraining the back. The symptoms of this injury, however, had largely subsided before onset of present complaints.

Past History.—The patient had measles several years previously. T and A was performed at seven years of age but subsequently occasional sore throats with rhinitis. No previous history of muscle or joint pains, usual health reported as good.

Family history was not remarkable.

Physical examination showed an acutely ill patient: temperature was 39° C., pulse was 120 and respiration 40. The face was flushed. Throat, lungs and heart were negative to clinical examination. Muscular resistance was found throughout the abdomen, with maximum tenderness in the right upper quadrant and at the umbilicus. There was no referred tenderness but definite rebound pain in the mid-right abdomen. Marked tenderness without induration on rectal examination. There was moderate spasm in the right lumbar muscles, tenderness in the right flank and over the spinous processes of

the ninth and tenth thoracic vertebra. The extremities were normal; leucocytic count was 30,650. Urine examination showed a trace of albumin, specific gravity 1.006 and negative otherwise.

Tentative diagnosis was acute appendicitis with perforation.

Operation was performed as an emergency. There was no free abdominal fluid. The peritoneum was normal on inspection. The appendix was free, normal in appearance. Intestines were normal. The liver was enlarged, its margin was at the umbilicus without peritonitis. The appendix was removed in the usual manner.

Post-operative Course.—There was considerable improvement in vital signs directly after operation, but the following day abdominal pain recurred in the right upper quadrant. Röntgenogram of chest revealed peribronchial feathering, moderate dilatation of heart with prominence of pulmonary artery. On the fourth day post-operative, moderate abdominal distention was present, moderate pain in the right lower quadrant persisted but the wound was clean. The temperature was 37.5°, pulse 80, respiration 20 and leucocytic count 7,600. Convalescence remained unchanged until the twelfth post-operative day when pharyngeal redness was noted and definite cardiac signs were evident. Two days later, signs of diffuse bronchopneumonia were found. Further enlargement of the heart with double precordial murmurs developed. The course was rapidly downhill; the patient expired on the sixteenth post-operative day. Post-mortem examination was refused.

Microscopical section of the appendix showed lymphoid tissue to be normal, the submucosa thickened, slight dilatation of the serosal vessels. No acute inflammation was present. Blood cultures on two occasions showed no growth at five days. Throat culture was negative for diphtheria.

Case III.—R. P., SMH No. 50,952, female, aged thirty-one, married, white, was admitted on September 13, 1931, with the complaint of low abdominal pain; onset was twenty-four hours earlier with nausea and pain in the mid-right abdomen; distention and vomiting occurred soon after onset of abdominal pain. The stools were loose without diarrhœa for two days. Urinary frequency without burning since onset of present illness. The pain remained in the right mid-abdomen. There was no vaginal discharge. No chill or fever was noted.

Past History.—The patient was one month prior to term in second pregnancy. Examination in pre-natal clinic two weeks before present illness revealed left border of cardiac dullness nine centimetres to the left of the midsternal line, action was regular, a rough systolic murmur in the precordium and soft systolic murmur over the pulmonic area were heard. The uterus was enlarged to seven months' pregnancy, fœtus in L.O.A. position. Nine years previously she had had scarlet fever with subsequent acute articular symptoms in the left knee. This had been quiescent except for occasional joint pains during interim to date. T and A was performed at nine years of age, measles sixteen years ago. Otherwise she considered herself in excellent health.

Family History.—Husband and one child well. No chronic or familial disease noted.

Physical examination revealed a well-developed and nourished woman. Temperature was 38° C., pulse 100 and respiration 20. There was no apparent change in the heart since earlier examination. There was moderate general abdominal distention without muscle resistance noted. Fundus was four fingers above the umbilicus. There was definite tenderness to the right of the fundus of the uterus with referred pain localized to the antero-lateral wall of the uterus on the right, which was more resistant to direct pressure than on the left. There was percussion pain over McBurney's point. There was no vaginal bleeding or discharge. Rectal examination revealed marked tenderness high on the right. Extremities were negative. Urine was negative. Leucocytic count, 11,400. Polymorphonuclears, 86 per cent. Wassermann was negative.

After four hours' observation, operation was performed with tentative diagnosis of acute appendicitis. The abdomen contained no free fluid or signs of inflammation.

Appendix was long, free, soft and contained three fecoliths. It was removed. The abdomen was closed without other procedure.

Post-operative Course.—Fourteen hours after laparotomy there was spontaneous delivery of 2,200 Gm. fœtus followed by gastric dilatation, 1,000 cubic centimetres contents being recovered without relief of symptoms. Pulmonary œdema developed rapidly and the patient expired four hours later.

Post-mortem examination revealed acute mitral, aortic and myocardial rheumatic lesions, pulmonary œdema, acute splenic tumor, cloudy swelling of the kidneys, lymphoid hyperplasia of ileum, fibrinous pericarditis and pleurisy.

Microscopical section of the appendix revealed round-cell infiltration about the vessels of submucosa and muscularis. No acute inflammation was present. The placenta was normal on section.

Case IV.—M. D., SMH No. 38,839, female, aged nineteen years, white, single, was admitted on October 20, 1931, with the complaint of low abdominal pain. The onset was one day previous with five diarrhœa stools and low abdominal cramps. The patient had fainted three hours later. Examination at that time revealed tenderness just above the internal inguinal ring on the right, while the vital signs were normal. The leucocytic count was 7,400. The morning following admission, she was awakened by "stabbing pain" in the mid-right lower quadrant which was followed by normal bowel movement without relief. Intensity of pain was less during the day but remained localized in the mid-right lower quadrant. There was no nausea or vomiting. A normal catamenia had ended four days previous to onset of symptoms.

Past History.—One year previous to present illness, a routine examination revealed calcified thoracic lymph-nodes, congenital shortening of the left leg ½ inch with left lumbar scoliosis. This deformity was largely corrected by elevation under the left heel. Five months previous to present illness, herpes zoster of left lumbar region at the level of the second lumbar vertebra was present. Three months before present illness patient had had transitory dizziness and paræsthesias of hands, nausea for two or three days and palpitation. Tonsillectomy performed two months ago was followed by a temperature of 37.5° C. for four days, pulse of 90–100 was present for several days after the operation. No cardiac changes were noted at any examination. In childhood patient had had the common diseases with occasional mild sore throat. Patient had not had scarlet fever or rheumatic fever. She had considered herself in good health until the past year.

Family history was negative for familial diatheses or chronic disease.

Physical examination showed a patient not acutely ill. Temperature was 37.5° C., pulse 88, respiration 20. The pharynx was negative, lungs were clear. Heart was not enlarged, action regular, soft systolic murmur at the apex was not transmitted. Blood-pressure was 110/60. Abdomen was symmetrical, moved on respiration, spasm of muscles was absent at first examination but one hour later it was noted in the upper and the lower right rectus muscle. Tenderness was found constantly about McBurney's point with pain on release of pressure. No referred or percussion pain was elicited. The right inguinal region was found to be normal. The extremities were normal. The urine was negative. Leucocytic count was 7,400.

The patient remained under observation for eight hours when operation was indicated because of continuation of symptoms. The tentative diagnosis was acute appendicitis. The abdomen contained no free fluid, the appendix appeared normal. A calcified gland in the mesentery was removed. Otherwise nothing abnormal was observed. Routine appendectomy was performed.

Post-operative course was not unusual for the first ten days. The wound healed by primary union. Twelve days post-operative she complained of pain in the ankles and knees. At this time a history of subcutaneous nodules of the insteps, three months earlier, for two weeks, was elicited. There was now moderately elevated temperature, definite increase in cardiac signs was noted. She responded to salicylate therapy.

Microscopical Section.—Appendix showed the lymphoid tissue to be abundant. No acute inflammatory reaction was present. The lymph-node was typically tuberculous in nature with fibrotic lymphoid tissue containing plasma cells at the periphery of the gland.

These cases serve to illustrate the difficulties encountered in differentiating appendiceal inflammation from the pseudo-appendiceal symptoms of rheumatism. In each case except the first, decision in favor of operation was reached only after careful differential diagnosis. Acute rheumatic fever however had not been considered as an etiological factor of the abdominal symptoms. Four other cases, not markedly dissimilar to these in history and abdominal findings, were held under observation because of evidence of active cardiac lesion. These latter patients responded to salicylate treatment without subsequent evidence of appendicitis.

A review of the microscopical sections obtained from the four specimens of appendix removed failed to reveal Aschoff nodules or perivascular changes similar to those noted recently in the lungs by Frazer[14] and other parts of the body by Meltzer.[15] Recently, studies by Kling[16] show that these, however, may occur only later in the disease, the early reaction to the toxæmia being extranuclear swelling of the fibroblasts. It is evident in view of the negative findings in the appendix that the clinician must reconsider the means of diagnosis in the hope that some sign will be developed to differentiate these two diseases. At present this is not available, but observation in the sequence of symptoms in rheumatism reveals them not to follow the usual typical findings of appendicitis.

There is little to be gained from analysis of abdominal pain. This is typical in proved appendicitis in less than 75 per cent. of the cases and pain may be typical for appendicitis without a true inflammatory process. Brennemen[17] has commented on the characteristic abdominal pain much like appendiceal colic associated with acute throat infections in children which is not often due to true appendiceal inflammation.

Vomiting, however, is markedly more constant in true appendicitis, being 90 per cent. positive in children or adolescents and not observed to be absent when diarrhœa occurs spontaneously at the onset of appendicitis.[18] However, in acute rheumatic fever with symptoms pointing to the right lower quadrant, the infrequency of vomiting is attested by Costedoat and others. In our four cases, it occurred but once and that in the case of an eight months' pregnancy.

The history of definite sore throat, coincident or directly preceding the onset of acute rheumatic fever, is often elicited, 30 to 40 per cent. And although Evans has shown such to occur occasionally before appendicitis, it is uncommon and is usually one to two weeks earlier. The abdominal pain following epidemic throat infections is characteristically referred to the umbilicus when not appendiceal in origin. Abdominal signs are variable as rheumatic manifestations. Muscle resistance when present is usually voluntary and is entirely inconsistent with the amount of tenderness which is more often than not marked and diffuse. All four of our cases had diffuse right-

sided abdominal tenderness but only one had true spasm, localized in the right lower quadrant. Different points of maximum tenderness may be recorded by two observers or may shift between observations by the same man in acute rheumatic fever. I cannot account for the rectal tenderness recorded in our cases. I have always considered it an important factor in doubtful cases of appendicitis and believe in these cases here it was an appreciable factor in deciding for operation. On more than one occasion, œdema of the pro-peritoneal tissue has been recorded during laparotomy in rheumatic cases without other evidence of peritonitis. There is no evidence to suppose that rectal tenderness is present, however, on this basis.

Certain manifestations of suppurative appendicitis when present are of a deciding factor. Britton reports a constant finding of contracture of the right cremaster on pressure over the appendix only when this organ is gangrenous. Jezierski[19] has noted myosis of the left eye from pressure in the ileocecal region in appendicitis but not in those cases simulating it. Livingston[20] describes a definite triangle in the right lower quadrant of hypersensitiveness of the tissues of the abdominal wall to pinching. He considers this highly constant, 86 per cent., in acute appendicitis prior to perforation. Increased sensitiveness outside this triangle has not been observed by him due to acute appendicitis. In the absence of any of these diagnostic signs, appendicitis cannot be excluded but will be considered less likely.

Although elevation of leucocytic count is a relatively constant finding in both these diseases, Yaguda[21] reports 671 appendectomies with Schilling count showing constant increase in the percentage of immature polymorphonuclear leucocytes, consistent with the degree of suppuration. This is an important observation as regards appendicitis alone but when correlated with the observation of Perry[22] that in rheumatic disease there is no "shift to the left or right," though the count may be 15,000 or more, is highly significant. The importance of the Schilling count in this differential diagnosis is attested by:

A girl, eighteen years of age, who was admitted to the Strong Memorial Hospital (No. 39,630) November 19, 1932, because of a dull pain in the right lower quadrant of the abdomen. The onset of pain was sudden, five days previously, while on her way to school. The pain was sharp, extended across the abdomen below the umbilicus without radiation to the back, perineum or lower extremities. Nausea occurred shortly after the onset and had been present intermittently until admission. There was no vomiting. The pain was less severe the day after onset although it had kept the patient awake that night and those following. A whitish vaginal discharge had been present throughout the present illness. The patient had taken a small dose of magnesium sulphate the first day of her illness. She had had regular bowel movements. There had been no fever or chills. The day of admission the pain had become more intense and was limited to the right lower quadrant of the abdomen. Last menstrual period ended two weeks before present illness.

The past history revealed that the patient had been admitted to this hospital two years previously because of pain in the right lower quadrant of the abdomen of two weeks' duration. Nausea or vomiting had not been present. She had had previous mild attacks for four years, often associated with onset of menses which were irregular.

There was slight vaginal discharge most of the time, worse when the patient was fatigued. On this admission temperature was 37.5° C., pulse 88 and respiration 20. There was slight tenderness at McBurney's point and voluntary muscle resistance in the right lower abdomen. The vagina was small with a firm, fibrous band in the lower rectovaginal septum. There was no tenderness or abnormal masses in the pelvis. The leucocyte count of the blood was 9,450. A definite diagnosis was not made, the attacks of low abdominal pain being considered dysmenorrheal in origin. Symptomatic treatment for this condition was directed by the gynecological service.

During the interim from the first to second admission, the patient had been nervous, apprehensive, with unintentional jerking of the hands and legs which was aggravated by emotional strain. She had had repeated upper respiratory infection during the winter months, although the tonsils had been removed eight years previously. She had had transient, infrequent attacks of headache and vertigo. Ophthalmic examination and glasses failed to relieve these attacks. She had not had any muscle or joint pain. Otherwise than as stated she had been healthy.

Family history showed nothing remarkable.

Examination on admission showed temperature 37.2° C., pulse 88 and respiration 22. She was well developed and nourished, not acutely ill. There were purposeless movements of the legs and arms with occasional jerky movements of the entire body. She had marked acne vulgaris of the face with hypertrichosis. The tongue was furred; there was lymphoid hyperplasia in the pharynx but no acute inflammation. Expansion of the chest was equal on both sides, the lungs showed no pathology to routine examination. The heart dullness to percussion was within normal limits; apical rate was 150 per minute with sinus arhythmia. The first muscle sound was markedly accentuated with systolic murmur at the apex not transmitted; second muscle sound was snapping in character; second pulmonic sound was greater than aortic. The radial pulse was rapid and small in quality. Blood-pressure was 105/70 millimetres mercury. The abdomen showed increased muscle resistance throughout the right lower quadrant. There was marked pain on deep pressure in the mid-right lower quadrant with marked pain on release of pressure and subsequent nausea. No masses were felt. Pressure in the left lower or either upper abdominal quadrants caused no pain. Pelvic examination showed organs in normal position without masses or tenderness. Extremities were well developed without paralysis; reflexes were bilaterally equal and active.

Laboratory tests showed urine—specific gravity 1.010, very slight trace albumin, otherwise negative. Leucocyte count of blood was 13,700, 84 per cent. of which were polymorphonuclear neutrophils in chamber count. Schilling differential count showed no juvenile cells; there were four stab cells and eighty-four segmented neutrophils in 100 cells counted.

A tentative diagnosis of chorea with question of acute appendicitis was made. Sodium bromide one Gm. and atropine sulphate .0006 Gm. were given and the patient admitted for observation.

Subsequent examinations showed persistent tenderness without spasm in the mid-right lower quadrant. Repeated leucocyte count of the blood was 13,700 without change in constituents from the earlier count. The character or intensity of abdominal pain was unchanged by drugs administered.

Because of the localization and persistence of symptoms, laparotomy was performed ten hours after admission. The appendix was found anchored to the posterior abdominal wall in the middle by a thin fibrinous band causing angulation but not constriction at this point. There were no signs of inflammation in the appendix or elsewhere in the abdomen. The uterus was small, retroverted and slightly tipped to the right. The right ovary was larger than the left, but not cystic. Appendectomy was performed.

Microscopical sections of the appendix were interpreted as normal for this organ, there being only slight increase in vascularity of the subserosal vessels.

Convalescence from operation was not remarkable, purposeless movements were more pronounced, being unaffected by nervinal forced to the patient's tolerance. The leucocyte count of the blood three weeks after operation was 12,500, polymorphonuclears being 66 per cent. One month after admission there was decrease in choreiform movements with complete cessation one week later at which time the patient was discharged.

Summary.—Certain patients suffering from acute rheumatic fever present abdominal signs and symptoms similar to acute appendicitis. Four cases of this nature, proved to be not appendicitis at operation, are reported. From these patients it is observed that the symptoms of acute rheumatic fever, although suggestive, are not identical with any of the usual types of appendiceal inflammation. The symptom for which medical attention is sought is mostly abdominal pain. The onset is in the mid- or lower abdomen, quite often severe or lancinating in character. Nausea occurs in the first few hours but vomiting, even in children, rarely is present throughout the illness. Spontaneous diarrhœa is occasionally present the first day or two of the abdominal pain. There is in the immediate or past history evidence of rheumatic fever. This type of patient on examination is often restless and apprehensive, complaining of increased abdominal pain on jarring or forced inspiration. Occasionally there is marked increase in the pulse rate with or without clinical evidence of early cardiac involvement. Abdominal tenderness is unquestionable, often present in both lower quadrants and at the umbilicus with the maximum about the base of the cæcum. Muscle spasm is absent, the voluntary resistance occasionally met with being noticeably less extensive in area than the tenderness. Hypersensitiveness of the abdominal wall in the right lower quadrant has not been observed in acute rheumatic fever. Rectal tenderness is present in a high percentage of cases. The leucocyte count of the blood is increased without increase in juvenile granular cells.[37]

The essential points in differential diagnosis are: lower incidence of vomiting, lack of spasm in the presence of diffuse and marked abdominal tenderness and normal Schilling differential with persistent leucocytosis in the case of acute rheumatic fever with onset by abdominal manifestations whereas in acute appendicitis, vomiting, especially before the age of twenty, is present in 90 per cent. of cases; spasm corresponds favorably in extent with the abdominal tenderness and the Schilling differential shows an increase in juvenile cells even when there is only slight increase in the number of circulating cells. In case, however, reasonable doubt persists after ten hours' observation, operation is advised as involving less risk in acute rheumatic fever than further delay in acute appendicitis.

CONCLUSIONS

(1) Certain cases of acute rheumatic fever manifest abdominal symptoms suggestive of acute appendicitis.

(2) At operation no causes for the symptoms in the right lower quadrant are found.

(3) There is no gross or microscopical evidence yet that rheumatic involvement of the appendix occurs.

(4) Vomiting, abdominal spasm and increase in Schilling count of the blood are singly and collectively relatively constant findings in acute appendicitis.

(5) Vomiting, spasm and increase in Schilling count of the blood are infrequent individually in acute rheumatic fever beginning with abdominal pain and tenderness, and have not been observed to occur collectively in such cases.

NOTE.—I wish to acknowledge the assistance of Dr. William Hawkins, of the Department of Pathology, in reviewing the pathological sections, and of Dr. Doran Stephens, of the Department of Medicine, in determining Schilling counts.

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THE DIAGNOSIS OF PHLEBITIS IN VARICOSE VEINS WITH THE AID OF THE SEDIMENTATION RATE *

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FROM THE VARICOSE VEIN CLINIC OF THE GERMAN POLYCLINIC

In searching the text-books and literature for information about phlebitis, one is impressed by the lack of interest shown regarding this condition. Not only is there an actual dearth of knowledge, but phlebitis is mentioned throughout as an unvarying entity without any attempt being made to classify its forms. One is therefore forced to formulate his own conception of phlebitis in order to intelligently consider the subject. The viewpoint presented here was reached after months of work at the Varicose Vein Clinic of the German Polyclinic spent in trying to establish a practical method of diagnosis for this troublesome condition.

At the outset it is important to point out the difference between phlebitis occurring in the normal vein and that condition in the dilated varicose vein. The ordinary phlebitic inflammation is usually readily recognized by the presence of a hard thrombotic process, plus the familiar signs of any inflammation; namely, redness, tenderness and heat. This diagnostic rule, however, does not suffice for the phlebitis of varicose veins.

The reason for the difference in clinical appearances is due to the fact that the varicose vein is the seat of a stagnant reverse flow[1] and its wall heals with great difficulty or not at all. On account of the abnormal metabolic conditions present, there is a great tendency for the inflammatory processes to remain chronic or latent for long periods of time. Furthermore, the tissues which are bathed by this vicious circulation tend to become infected for long periods, and so act as a focus for the continuation of phlebitic processes.

The stagnant blood pool present in varicosed extremities offers an ideal culture medium for bacteria that may be fed into the circulation from any focus in the body. Thus, an acute phlebitis may arise spontaneously without apparent cause or following some trivial injury. Another cause of an existing phlebitis is that it may be present as a "hangover" from a post-partum or post-operative phlebitic infection. It is a common experience for one who treats this condition to find evidences of phlebitis existing years after an initial post-partum "milk-leg" infection. In addition, the various toxins that cause phlebitis in normal veins may, of course, operate with greater force in these less resistant tissues.

It is necessary to call attention to various types of phlebitic inflammation occurring in dilated veins. The very acute types are readily recognized be-

* Read before the East Side Clinical Society, April, 1933.

cause of their resemblance to phlebitis elsewhere. However, the milder phlebitides often pass unrecognized and are responsible for many complications that arise in the injection treatment of today.

These milder inflammatory processes sometimes have suspicious characteristics. Thus, the patient may complain of pain and examination may disclose tender thromboses which show a definite hyperthermia. However, in other cases the signs of infection may be very slight, so that the operator is often in doubt; especially since many normal varicosed extremities are tender and warm to the touch. In addition, it is possible to get so-called latent infections which have practically no physical signs that would help in the diagnosis. All these infected veins must be differentiated from the uninfected, relatively normal, dilated fibrous vein. It can thus be seen that cases of phlebitis may present varying degrees of inflammation starting from the typical acute form and extending without any dividing line down to the slumbering infections.

That this is not mere conjecture has been proven often to the distress of the operator and the patient by the occurrence of acute flare-ups in supposedly normal veins. These flare-ups come after an incubation period of two to ten days. This leads one to suspect that peacefully slumbering bacteria have been encouraged to grow and make their presence felt after a sufficient lapse of time. Formerly, these reactions were very puzzling and were attributed to chemical irritation. However, the presence of the incubation period and the spreading nature of the process stamps them in my mind as inflammatory phenomena.

The work of DeTakats[2] amply bears out this idea. He excised the saphenous vein routinely in a series of cases and planted the segments in a nutrient medium. He found that 50 per cent. of apparently normal veins harbored bacteria. These bacteria grew slowly and only showed up in culture after three to ten days. This fact falls in line with the clinical evidences of slumbering infection mentioned above.

The importance of recognizing phlebitis in any form cannot be overestimated. The few cases of fatal embolic phenomena that were once reported are now readily understood. The explanation is that in these cases irritating solutions activated existing infections to cause the formation of a friable infected clot, rather than the aseptic firm thrombosis which one seeks. In addition to these disastrous happenings, many occurrences of milder activation have taken place to the great discomfort of the patient. If the danger of arousing phlebitic processes in varicose vein therapy could be eliminated, one would have a more nearly perfect form of therapy.

The importance of diagnosing this condition is therefore apparent; but up to the present time there has been no satisfactory method available, reliance having been placed on clinical signs. Clinical evidence, however, will not suffice for diagnosis, so at the German Polyclinic for the past year the method described below has been in use.

The blood sedimentation rate has been employed to estimate the degree

of inflammation that is present. Since this test is not specific in phlebitis, other conditions must be eliminated in order to properly evaluate its significance. In other words, a positive test indicates the presence of phlebitis only in the absence of any other infection. However, with proper exclusion of other factors, it gives us information of great value.

It must also be pointed out that the test is roughly a quantitative one in that it estimates the degree of inflammation present. Thus, one is able to form a conception as to the amount of activity that is present. This is a good guide for determining the type of treatment to be used.

The test is made in the usual manner by mixing 0.2 cubic centimetre of 5 per cent. sodium citrate with 0.8 cubic centimetre of whole blood in a 1 cubic centimetre graduated sedimentation tube, and the time noted during which the column falls to the 18 millimetre mark. A time interval below one hour is indicative of fairly active inflammation. Rates of two hours or more indicate the probable absence of any activity. Table I illustrates the use of this method in fifty cases.

In analyzing Table I, one must be careful to evaluate all the factors present in each case, so as not to be drawn into false conclusions. In a few instances the test apparently falls down, but here closer scrutiny reveals factors that have not been fully appreciated. One is impressed in this study by the ease with which complicating infections are discovered and ruled out simply by thorough routine examination.

The cases enumerated are purposely diversified in type so that a number of influences can be studied in their relationship to the sedimentation rate of phlebitis. The inclusion of the hæmoglobin percentage was made in order to rule out slow sedimentation rates due to anæmia.

The first three cases are ones in which phlebitis was proven present. In the first case, it was questionably present, but the sedimentation time of twenty-five minutes, in addition to the physical signs, made the probable diagnosis a definite one. The second case was a definite phlebitis, and here the sedimentation time of twenty minutes confirmed the diagnosis. Case No. 3 gave a history of phlebitis fifteen years ago, but the question of the existence of a latent infection could not be answered clinically. It was decided to treat this case and a severe migrating phlebitis occurred following the injection of 2 cubic centimetres quinine. This was undoubtedly due to the lighting up of a latent phlebitis. The sedimentation rate of twenty minutes should have been a warning not to inject this case.

The fourth patient gave a rather rapid rate of forty-four minutes, but subsequent treatment proved uneventful. The presence of a severe widespread lymphangitis was the probable cause of this rapid rate, since there was no phlebitis actually present. Case No. 6 had tender thrombosed segments, but no phlebitis, as shown by the sedimentation time of one hour and fourteen minutes. Without the sedimentation test as a guide, this case would have been left untreated on account of the suspicion aroused by clinical signs.

TABLE I

Case	Phlebitis	Other Inflammatory Conditions	Ulcer	(Tall-qvist) Hgb.	Remarks	Sed. Time Hrs.
1	Questionably present	N.	Pres.—1 yr.	90%		0 25/60
2	Pres.—10 days, 1st attack 2 yrs. ago for 2 mos.	N.	N.	85%		0 20/60
3	15 yrs. ago, both legs	N.	N.	80%	Got severe migrating phlebitis—rt. leg after 2 cc. quinine	0 20/60
4	Questionably present	N.	5 ulcers pres.—3 yrs.	80%	Ulcer on bed of hard lymphangitic induration	0 44/60
5	N.	N.	N.	75%	Simple goitre for 7 yrs.—B. M. R. (—5%)	1 14/60
6	N.	Foot infection recently healed. Has tender thrombosed segments	N.	80%	Treatment without untoward result	1 14/60
7	N.	N.	Pres.—3 mos.	85%		3 25/60
8	N.	N.	2 ulcers pres.—2 mos.	80%	Large hernia	2 20/60
9	Pres.—rt. leg for 1 yr., redness, tenderness	N.	N.	70%	Did not inject	0 48/60
10	N.	N.	N.	80%		2 55/60
11	N.	N.	N.	75%		2 00/60
12	N.	N.	N.	90%		2 42/60
13	N.	Rt. sacro-iliac arthritis	N.	90%		0 30/60
14	Attack 2 wks. ago, 1st attack June, 1932	N.	N.	85%	Painful phleb. pres.—patient was cautiously treated	1 20/60
15	N.	N.	N.	85%		1 22/60
16	7 yrs. ago on history	N.	Pres. on lt. ext. malleolus	85%		2 00/60
17	Active phleb. 6 mos. ago, 1st attack 2 yrs. ago	N.	N.	80%	Got severe reaction in lt. leg after 2 cc. quin.	0 50/60
18	N.	Sacro-iliac arthritis	N.	80%		0 37/60
19	Questionably pres.—P. P. phleb. lt. leg 20 yrs. ago	N.	N.	85%	Treated successfully although tender lumps were pres.	1 00/60

20	N.	N.	Healed	90%		1 2/60
21	12 yrs. ago	Pain in knees	Healed	85%	Treated	1 25/60
22	6 mos. ago	T. A. O.	Present	80%	Expired Jan., 1933—intra-abdominal condit.—untreated	2 31/60
23	Questionable	N.	½ yr. ago	80%	Tender, hard indurated area pres.	4 10/60
24	Indefinite history	N.	N.	95%		1 42/60
25	Active phlebitis attack 8 yrs. ago	N.	N.	90%		0 50/60
26	Tender vein in lt. leg	Arthritis rt. ankle	N.	90%	Treated	1 4/60
27	N.	N.	N.	75%	16 injections	1 30/60
28	N.	N.	N.	80%	6 injections	1 20/60
29	N.	N.	N.	90%	6 injections	2 26/60
30	N.	N.	N.	90%		2 00/60
31	N.	N.	N.	90%		3 49/60
32	N.	N.	N.	80%	Cramps on walk. Watch for T. A. O.	1 1/60
33	Rt. popliteal area tender 3 yrs. ago	Fistula in ano 3 yrs. ago	N.	80%	Arteriosclerosis pres., chronic nephritis	1 6/60
34	N.	N.	N.	90%		2 25/60
35	N.	N.	N.	80%		3 28/60
36	N.	N.	N.	90%		2 32/60
37	N.	N.	N.	90%		5 30/60
38	N.	N.	N.	95%		4 12/60
39	N.	N.	N.	100%	Trace albumin pres.—10 inj.	0 50/60
40	Attack 1 yr. ago	N.	N.	100%	2 cc. Na. morr. gave chemical migrating phleb.	1 13/60
41	N.	Chr. hyp. arthritis rt. knee	N.	90%		1 5/60
42	N.	Chr. arthritis lt. knee	N.	95%	Trace of sugar	1 18/60
43	N.	N.	Pres.—(luetic?)	100%	Chr. nephritis plus-minus Wass.	1 15/60
44	N.	N.	N.	100%	27 injections	1 20/60
45	N.	N.	N.	100%	24 injections for capillaries	2 25/60
46	Skin lesion or phleb.?	N.	N.	90%	Migrating charac. of tender lumps caused confusion	3 00/60
47	Questionably present	N.	N.	90%	Thrombosed segments sl. tender quest. activity	2 20/60
48	N.	N.	N.	100%		2 20/60
49	N.	N.	N.	90%		4 25/60
50	N.	N.	N.	90%		2 7/60

The eighth case had two ulcers, but the sedimentation time was normal. This last finding proved constant throughout the series. Varicose ulcers do not influence the rate of sedimentation of the blood-cells.

The above illustrations are given in order to explain how the table is to be interpreted. Invariably, it was found that complicating inflammatory conditions, especially the arthritides, influenced the sedimentation rate markedly. In other words, a rapid sedimentation time in the presence of arthritis is of no value in the diagnosis of phlebitis.

On the other hand, a number of non-inflammatory complications are to be noted in the series which did not affect the sedimentation time. These include albuminuria, traces of sugar, hernia and simple goitre. The hæmo-

FIG. 1.—Illustrating the difficulty of diagnosing phlebitis by clinical signs. This case had thromboses, hyperthermia and tenderness, but no phlebitis. Treatment uneventful.

FIG. 2.—A case of varicose veins with ulcer that was apparently normal. However, the sedimentation rate was below an hour and the injection of quinine caused a migrating phlebitic reaction.

globin percentages also had very little bearing on the rates, since they ranged between 70 per cent. and 100 per cent. in the whole series.

It should be noted that every case presenting a definite active phlebitis gave a definite rapid sedimentation time. It should also be noted that in a number of cases where the diagnosis of phlebitis was in doubt, the sedimentation time settled the question for us. Furthermore, in those cases where the warning of a latent phlebitis, as evidenced by a rapid sedimentation time, was disregarded, migrating reactions were secured.

Another point of interest in connection with the technic is brought out by those cases which had received injection therapy prior to the test. In some of these, a little more rapid rate than normal was secured. This means that

the chemical phlebitis, caused by sclerosive injections, influenced the sedimentation rate. Therefore, to secure uniform results, one should make this test before beginning treatment.

Despite careful interpretation there still remain a few contradictory results which are unexplainable on any basis. This does not to my mind destroy the value of the test since it must be understood that any laboratory procedure is open to various errors. This is especially true in the case of the sedimentation test because the explanation of the settling phenomenon is as yet unknown. The delicate physical-chemical action which operates to cause a more or less rapid settling of red blood-cells can be conceivably upset by trifling changes in technic. However, with increasing experience there is no doubt but that this test will grow in usefulness.

CONCLUSIONS

(1) Phlebitis in the varicose vein is peculiar in that chronicity and latency of infection are the rule.

(2) Many apparently normal varicosed extremities harbor latent infections that may be aroused by chemical irritation.

(3) Clinical evidence alone will not always suffice for the diagnosis of phlebitis in varicose veins.

(4) The blood sedimentation time has been employed to estimate the degree of inflammation that is present.

(5) A sedimentation time under one hour in the absence of other inflammatory conditions points to the presence of phlebitis.

(6) The presence of clinical signs, plus a rapid sedimentation rate, is definite evidence of phlebitis, in the absence of complicating infections.

(7) A sedimentation rate over two hours probably indicates the absence of phlebitis.

(8) Varicose ulcers do not influence the sedimentation time.

(9) This test should be a routine procedure before beginning the treatment of any patient exhibiting varicose veins.

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SCLEROSING INJECTIONS IN SURGERY

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In May, 1931, Porritt[1] wrote on the injection treatment of hydrocele, varicocele, bursæ and nevi using 5 per cent. sodium morrhuate. Since 1929, we have been using an injection method in many surgical conditions. The excellent results have prompted us to present this preliminary article in the hope that other men will report their experiences with this method or devise a still better technic.

The following are the conditions in which the treatment has been applied: (1) *Bursitis.*—Elbow, knee, *etc.*, especially pre-patellar and olecranon bursitis. (2) *Cysts.*—Mucous cysts of mouth, thyroglossal, branchial, sebaceous, ranula. (3) *Sinuses.*—Thyroglossal, branchial, dermoid, and other surgical sinus, non-tuberculous, syphilitic or malignant. (4) *Hemangiomata.*—Tongue, face, scalp. (5) *Ganglion.* (6) *External Hæmorrhoids.* (7) *Vaginal Varices.*

Sclerosing Solution Used.—Many solutions can be devised having the sclerosing effect. We have chosen the following formula which consists of: Phenol, 45 cubic centimetres; borax, 16 grams; acid salicylic, 16 grams; glycerin, 120 cubic centimetres; spirits of camphor—enough to make 240 cubic centimetres. The mixture is easily prepared, clear, never forms a sediment and readily flows through a small-calibre needle. The solution is slightly yellowish in color. If not kept in a dark colored bottle a reddish-brown color develops. This no doubt is due to the carbolic content. No special precaution is necessary to keep the solution sterile owing to the high phenol content. A bottle of the solution exposed to the air for some time proved to be sterile on culture. The best method of handling the solution is in a small bottle dark in color, with a rubber stopper through which a needle can be readily introduced. This allows the use of the same technic as in handling sera.

Anæsthesia.—Two per cent. novocaine solution is the local anæsthesia of choice.

Equipment.—Several sized syringes and needles for aspiration and injection are necessary, the size depending on the amount of fluid to be aspirated and the viscosity of the fluid exudate or secretion. The injection of the sclerosing solution is usually made with a two-cubic-centimetre Luer syringe and 25-gauge needle or the injection is made through the same needle that was used for aspiration.

Bursitis.—In the treatment of bursæ, especially those not communicating

* Read before the New York University Medical Society, November 7, 1932.

with a joint, notably the olecranon and pre-patellar bursæ, the fluid is aspirated and from one cubic centimetre to three cubic centimetres of the solution is injected through the same needle; the needle is then removed and a compression strapping applied. As a rule, one injection suffices. If there is any slight recurrence of effusion, it is readily absorbed within two weeks without reaspiration or reinjecting.

If at the end of two weeks the effusion has recurred to a moderate extent a second aspiration and injection may be necessary. Occasionally three aspirations and three injections have been required. The failure to attain satisfactory results has been found to be due to concretions (fibrinous or otherwise) in the bursæ. In cases therefore which are stubborn to treatment it is necessary to make a small incision into the bursa, to evacuate the solid contents and effusion, and the reinjection of the sclerosing solutions.

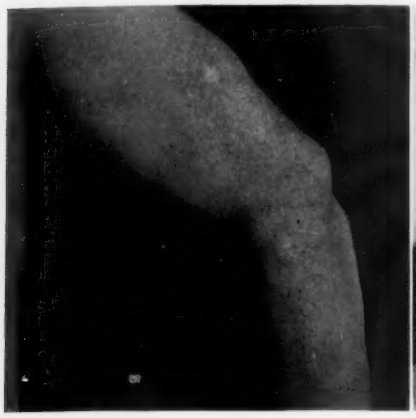

FIG. 1.—Bursitis about left elbow-joint of one year's duration.

FIG. 2.—Complete cure with no recurrence after 2 years' follow-up.

Porritt[1] makes special emphasis that this treatment should not be applied in bursæ connecting with joints. We have injected such bursæ notably in the popliteal space and about the elbow-joint with excellent results and without any untoward effect to the joint. However, in the injection of bursa which might communicate with a joint one should proceed with caution.

The usual reaction after injection varies from slight redness and tenderness to marked signs of inflammation. In every case, however, the inflammation subsides within the two weeks' period between injections without infection or sloughing.

The following case reports serve as examples of the clinical application of this treatment, in the more difficult cases.

Fig. 1 is a case of a white adult, aged fifty-four years, complaining of a "lump" in the left elbow of one year's duration. After complete study the diagnosis of bursitis about the left elbow-joint was established. December 2, 1930, five cubic centimetres of turbid straw-colored fluid were aspirated and two cubic centimetres of sclerosing fluid

were injected through the aspirating needle. Patient complained of some heat, redness and slight pain for three days, which then subsided.

December 15, 1930, three cubic centimetres of turbid fluid were aspirated and two cubic centimetres of sclerosing fluid injected. December 31, 1930, two cubic centimetres of blood-tinged turbid fluid were aspirated without any further injection of sclerosing solution. Fig. 2 represents the result of the case. December 30, 1930, the bursitis had completely disappeared. At this time, on routine Wassermann examina-

FIG. 3.—Bursitis in right popliteal fossa of six months' duration.

tion, it was found that the patient had syphilis and he was referred for treatment. The bursitis disappeared in spite of the existence of syphilis.

Fig. 3 is a case of a white male, aged fifty-two years, a carpenter, complaining of swelling at back of right knee for six months' duration, since July, 1930, with pain and swelling for three weeks since November 1, 1930. The diagnosis of chronic bursitis in right popliteal fossa connecting with knee-joint was made. Röntgen-ray and other laboratory tests were negative.

November 22, 1930, sixty cubic centimetres straw-colored fluid obtained. One

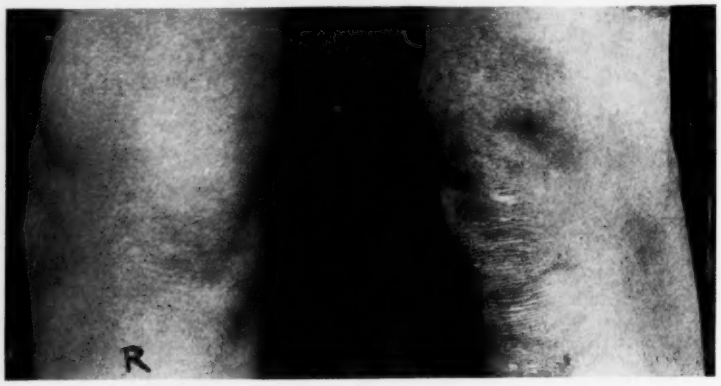

FIG. 4.—Bursa completely obliterated with four injections of sclerosing solution with no recurrence after two years' observation.

and a half cubic centimetres sclerosing fluid injected. November 30, 1930, thirty cubic centimetres fluid aspiration; some tenderness. One cubic centimetre sclerosing fluid injected. December 28, 1930, swelling decreased in size. Some tenderness. January 8, 1931, forty cubic centimetres of fluid aspirated. Two cubic centimetres injected. January 21, 1931, seven cubic centimetres fluid aspirated. Two cubic centimetres sclerosing fluid injected. No pain. No swelling. February 14, 1931, no recurrence.

Fig. 4 shows the result. The bursitis has completely disappeared without any further recurrence after follow-up examinations.

Cysts.—The following types of cysts have been treated by the injection method: Mucous cysts (buccal mucous membrane); thyroglossal cysts; branchial cysts; sebaceous cysts; ranula.

Mucous Cysts of Mouth.—These cysts are usually very resistant to excision, electrocoagulation and radiation. The injection treatment gives excellent results.

The cyst is aspirated of its thick mucinous contents and one-half of one cubic centimetre of solution is injected. An 18-gauge needle should be used as the thick secretion flows with difficulty through needles of smaller bore. Within one week the cyst cavity will be obliterated and replaced by a "pea"-sized mass, which will be absorbed within one month. In the cases which we have treated a single injection has sufficed. However, more resistant cases may be encountered and in that event re-injection or incision may be necessary as in treatment of bursæ.

Thyroglossal and Branchial Cysts.—Treatment of these cysts is identical to the treatment of bursæ with the exception that two or more injections are necessary to effect a cure. The dosage of the sclerosing solution varies from two to four cubic centimetres depending on the size of the cyst and also the age of the patient.

In young children smaller doses, such as one cubic centimetre should be used. In the majority of these cases there is a slight inflammatory reaction of which the patient should be warned, prior to injection. Often it takes as long as three weeks for this inflammation to entirely subside, and thus injection every three weeks instead of every two weeks is indicated.

Sebaceous Cysts.—Though excision of sebaceous cysts is the procedure of choice, for cosmetic reasons, or because the patient refuses surgical intervention, the injection method of treatment may be used. The most applicable locations are cysts of the face and neck. The cyst is incised by making a quarter-inch incision under novocaine anæsthesia and its contents thoroughly expressed. The cavity should then be washed out with saline, under pressure, by using a needle and hypodermic syringe.

Sufficient sclerosing fluid is injected to fill the cavity. The excess will flow out of its own accord onto the dressing. Dressing should be done every two days until the cyst disappears. At each dressing care should be taken that the opening of the cyst cavity remains patent for free drainage. At every other dressing a small amount of fluid is injected into the cyst cavity if necessary.

A benign inflammatory reaction occurs in the majority of cases. Usually the cyst completely disappears in three or four weeks. In treating sebaceous cysts of certain location such as the scalp, the actual cyst wall becomes completely detached from the surrounding tissues and can be picked out in one piece through the opening originally made for injection and drainage. It is a good plan to inject one-quarter to one-half cubic centimetres of

sclerosing fluid directly into the cyst several days before incising cyst so that there is thorough liquefaction of the cyst contents. This procedure causes a moderate inflammatory reaction. While this preliminary injection is not necessary it is one to be recommended.

Ranula.—While an apparently benign surgical condition, ranula is very annoying and distressing to the patient and it is not readily amenable to surgical intervention unless the procedure be extensive and radical. The injection method as employed has proven at least in the cases (4) so treated a simple and effective method.

The mouth is washed out with sodium perborate solution or any other mouth wash. A small area at the summit of the ranula is dried with a sterile pledget of cotton on a swab and painted at that point (one-quarter inch in diameter) with tincture of iodine. Using a fine hypodermic syringe and 2 per cent. novocaine solution a small wheal is raised in the sterilized area. An 18-gauge needle (ordinary Wassermann needle) on a five- to ten-cubic-centimetre syringe is introduced through the anæsthetized area into ranula cavity

FIG. 5.—Ranula of one year's duration.

FIG. 6.—Ranula obliterated with no recurrence after two years' observation.

and its contents thoroughly aspirated. Through the same needle one-half to four cubic centimetres of sclerosing solution are injected. The needle is then immediately removed and pressure applied for five or ten minutes at the site of injection so that there is no leakage and the lining wall of cyst is acted upon by the solution. The patient usually complains of a burning sensation which subsides in a few minutes. There may be a secondary inflammation in the cyst wall which readily subsides in two or three days. Curiously enough, the needle puncture wound remains open for a long time, giving drainage to the ranula. This opening closes invariably and the ranula recurs usually to one-third or one-half the original size. This occurs in from two to three weeks, at which time reaspiration and reinjection are necessary. It is interesting to note that at this stage the ranula wall is thickened and inelastic. The same procedure for reinjection is used as before. At each successive reinjection the recurrence is smaller and smaller until there is complete disappearance. The accompanying case is an illustration.

Fig. 5 shows a case of ranula of one year's duration in a young woman. September 26, 1930, three cubic centimetres of a thick seromucous secretion were aspirated and one cubic centimetre of sclerosing solution was injected through the aspiratory needle.

October 6, 1930, ranula completely disappeared except for a slight loculus, which was not injected. October 17, 1930, loculus increased in size, being three-quarter inches in length and three-eighth inches in diameter. At this time one-half cubic centimetre of sclerosing solution was injected into loculus. Loculus completely disappeared until November 30, 1930, a one-quarter-inch loculus recurred. This was injected with four minums of sclerosing solution. Many follow-ups on this case show no further recurrence since that time. (Fig. 6.)

Sinuses.—The injection treatment has been applied successfully in chronic sinuses (of non-tuberculous, syphilitic or malignant nature), as thyroglossal, branchial and dermoid-cyst sinuses. The sinus is probed to determine its extent and also röntgenographed after lipiodol injection for the same purpose. A 25-gauge Luer syringe needle is broken off at the base and the remaining base is used as a canula for injecting sinus under pressure. Using the usual sterile precautions the base of the needle is attached to a two-cubic-centimetre Luer syringe containing sclerosing solution. Introducing the canula in the mouth of the sinus the sclerosing solution is injected under pressure and held in that position for several minutes or the canula is withdrawn and pressure applied at the opening of sinus to prevent immediate leakage of the injected solution. The excess fluid is then allowed to drain spontaneously.

As a rule there is only a temporary burning sensation but in twenty-four to forty-eight hours a marked inflammatory reaction occurs. The inflammatory reaction consists of redness, swelling and some pain. There is no general reaction and the local one readily subsides under the régime of wet dressings. Usually a single injection closes the sinus for a long time. Our single injection cases are too recent at present to allow us to judge of their permanency. In those which recur reinjection should not be attempted until all inflammation has subsided and definite secretion is again pouring forth from the sinus. The sinus is considered as closed until there is recurrence of drainage. Reinjection is repeated until condition is permanently healed. We are not in this preliminary report able to give the limits of the number of injections necessary. We only can say that one or more are necessary.

Hemangiomata.—Hemangiomata of the tongue, lips, face, *etc.*, have always presented great difficulty to surgical intervention whether it be by sharp dissection, electrosurgical methods and even radiation. The injection method by sclerosing solution has simplified their eradication. When one excises a hemangioma of lip or tongue there is danger of marked hæmorrhage and the cosmetic results on the local areas operated on are always questionable. In the injection treatment, however, there is no interference with the local healthy parts nor is there any sloughing. To treat the hemangiomata of the lip or any other part of face the usual aseptic and antiseptic precautions are taken. A 25-gauge needle connected with a Luer syringe (two cubic centimetres) containing sclerosing solution is introduced at the base of the hemangioma going through healthy tissue and ending in the hemangioma proper. Blood at times can be aspirated but that is not necessary since the

needle can be readily felt within the cavity of the hemangioma. From .2 to .5 cubic centimetre sclerosing fluid is injected and needle withdrawn. The reason for introducing the needle from healthy tissue into the tumor is to avoid post-injection hæmorrhage and sloughing, or sloughing and hæmorrhage. Immediately after injection the hemangioma becomes firm, slightly swollen, grayish in color and slightly tender. As soon as the tenderness subsides reinjection may be repeated. This procedure should not be repeated, however, more often than every two weeks. As a rule, hemangiomata of the tongue require a single injection while those of the lips and face two to five injections depending on size of lesion. Invariably we have been able to completely cause the disappearance of the lesion without any sloughing, general reaction of any distortion of the area involved. The patient may be sent home directly after injection, thus making it an office procedure. The action of the solution seems to be the same as in the varicose vein injections.

Fig. 7 is a case of multiple hemangiomata of tongue in a twelve-year-old girl. Five minums of sclerosing solution were injected into each of the two hemangiomata

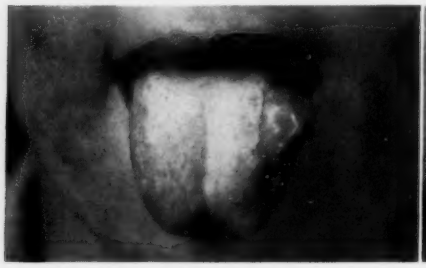

FIG. 7.—Multiple hemangiomata of tongue.

FIG. 8.—Hemangiomata completely obliterated with a single injection. No recurrence after two years' observation.

October 1, 1930. The masses became hard and pink in color and completely disappeared within one month. There was no pain, no sloughing nor any other untoward symptoms. Fig. 8 shows the final result. No recurrence noticed after long period of follow-up.

Ganglion.—Ganglia have not responded to the injection treatment as well as the other conditions described. They are treated in the same way as bursitis, using, of course, the same technic and precautions. If a ganglion is unilocular and the contents not organized to a great extent, one obtains brilliant results. On the other hand, the multilocular organized ganglion does not lend itself easily to the injection treatment for obvious reasons.

External Hæmorrhoids.—These are not usually treated by the injection method using the usual preparations for injecting varicose veins. With the sclerosing solution, however, one can readily treat such lesions by using the same technic as injecting hemangiomata. The importance of injecting the external hæmorrhoid by introducing the needle from healthy tissue into hæmorrhoid is here stressed. As a rule there is marked swelling of the hæmorrhoid which gradually subsides and is completely obliterated. A single

injection usually suffices of from .1 to .3 cubic centimetre. No general reactions are obtained. Locally there is a temporary burning sensation which readily subsides without sloughing. If injection is made directly into external hæmorrhoid surface oozing and sloughing may occur at site of injections.

Vaginal Varices.—These can be treated readily using the sclerosing solution. The veins are injected with .1 to .2 cubic centimetre in one or two segments of the varices weekly until they disappear. No sloughing or general symptoms occur.

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ASEPTIC END-TO-SIDE ILEOCOLOSTOMY: CLAMP METHOD

TECHNIC AND STATISTICAL DATA

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and
A. Stephens Graham, M.D.
of Richmond, Va.

Since the original description[7] of the method under consideration there have been a considerable number of requests for a more detailed description of the technic involved and for illustrations that will more clearly depict the various steps in the procedure. With this in mind, and in view of the fact that sufficient time has elapsed since the original article to enable us to report on the end-results in sixty consecutive cases, both from the standpoint of post-operative mortality and ultimate functional results, we have been prompted to write the present article.

End-to-side anastomosis between the terminal ileum and the transverse colon in instances where it is desired to resect the right half of the colon either immediately or subsequently is in our opinion decidedly the most satisfactory method. The greatest advantage of end-to-side anastomosis is the ability thereby to sidetrack the fecal current from passing over an ulcerating surface. It is our belief that the necessity of a graded operation is largely dependent upon the amount of infection around the primary growth which not only renders immediate resection hazardous but gravely undermines the individual's powers of resistance. Reduction of this infection and rehabilitation are two steps which are not to be gainsaid in successful attack on right colonic lesions. Moreover, the end-to-side anastomosis more nearly approaches the natural anatomical relationship of ileum to cæcum.

Cannon and Murphy[2] and others have demonstrated by animal experimentation that lateral anastomosis is an unphysiological procedure. Severing the circular muscle fibres in lateral anastomosis abolishes peristalsis in the region of the anastomosis, and the blind pouches at the ends fail to empty completely. The stasis that tends to develop at the new juncture and the concomitant attempt on the part of the normal segment of bowel proximal to this point to overcome the obstacle probably accounts for the upper abdominal discomfort frequently mentioned by patients in whom lateral anastomosis has been established. Cannon and Murphy have further shown that in end-to-end anastomosis there is no stasis of the intestinal contents at the site of the union. However, it has been our experience that in a majority of instances a two-stage procedure is desirable, either because of the general debility of the patient and associated profound anæmia, or due to inflammatory nature of the lesion, or to a combination of both conditions. Under such circumstances it would

be necessary either to form a lateral or an end-to-side anastomosis. Moreover, we have found it convenient in any case first to establish the end-to-side anastomosis between the terminal ileum and the transverse colon and then to determine from the immediate condition of the patient if resection of the right segment of colon is justifiable at the first operation. Not infrequently a patient who appeared in satisfactory condition for a single-stage maneuver at the commencement of the operation proved at the completion of the anastomosis of the ileum to the colon to be in a less favorable state. Careful questioning of many patients who have borne an end-to-side anastomosis over a period of more than a year has failed to elicit histories of abdominal discomfort or pressure sensations at the site of anastomosis, frequently complained of by patients in whom the lateral union has been made.

In contemplating any method of anastomosis between two segments of bowel one must take into consideration certain important technical factors such as ability to accurately approximate the bowel edges, adequacy of blood supply, liability to obstruction from stricture formation or excessive diaphragm, probability of hæmorrhage, and danger from contamination or subsequent leakage at the line of suture. In our opinion, the end-to-side procedure (when the union is between the colon and ileum), is attended by fewer technical difficulties in a greater number of cases, and by less danger, than is the end-to-end anastomosis, notwithstanding the general impression that the converse is true. One frequently encounters considerable disparity in the diameters of the ends of bowel about to be united, even after an attempt is made to compensate for this difference by dividing the ileum at an angle. Further compensation must be made at the expense of accurate approximation by continually taking wider bites on the colonic side and in this manner produce a sort of pleating effect throughout its circumference. Not only does this prevent accurate union but it would seem to inhance the opportunity for contamination and subsequent leakage at the line of suture. In well over 100 cases, which include in addition to our sixty those cases that have been reported to us by other surgeons, there has not occurred a single post-operative hæmorrhage. And in our own sixty cases there was no obstruction at the site of anastomosis, yet in not a single instance was an enterostomy established proximal to the anastomosis. Infection at the site of union and subsequent leakage must be extremely rare since it did not occur in our series, although two patients died and one revealed evidences of peritonitis. In the latter case there was no evidence of leakage at the anastomosis on post-mortem examination but the growth in the cæcum was large and infected, with evidences of subacute perforation. It is energetic palpation of such growths at the time of exploration that will more often be the cause of a fatal peritonitis than leakage about the line of suture. The good clinical results, we believe, bear out the experimental advantages demonstrated by one of us (Graham[3]) in Mann's laboratory. These animal experiments, which have been previously reported, elicited the following results: absence of post-operative hæmorrhage, absence of leakage at the site of anastomosis, absence of

circular constriction, almost complete absence of a diaphragm within the lumen, and absence of diminution in the diameter of the lumen.

The theoretical objections to the clamp method of anastomosis such as have been recently made by Briggs and Whitaker[1] cannot stand in face of practical results. Similar objections have been frequently raised in regard to the basting-stitch method of Kerr,[5] but many surgeons, including ourselves, have convincingly demonstrated by practical application of this very satisfactory procedure that the fear of obstruction from the infolding of too much tissue, or of hæmorrhage, need not be any greater than in open anastomosis of the intestines.

In sixty consecutive ileocolostomies in which the clamp was employed, there were four operative deaths, or a mortality rate of 6.6 per cent. One of these who died was aged eighty-one years and at necropsy a marked acites and bilateral pneumothorax were noted. Another, aged fifty-seven years, died of peritonitis but without evidence of leakage at the line of suture. The growth in this case showed evidences of subacute perforation. Still another died of pneumonia. The fourth to die was a patient in whom metastases were found throughout the abdomen, with pronounced involvement of the liver. It was assumed that he died of hepatic insufficiency. There was no evidence of peritonitis, obstruction, cardiorenal pathology or pulmonary complications at necropsy. All four were operated on for carcinoma of the right segment of the colon. Forty-two of the series were diagnosed carcinoma of the right colon, nine hyperplastic tuberculosis, four infective granulomata, one an irreducible intussusception, two fæcal fistulæ, one as fibroma of the cæcum, and one as extensive adhesions. In two instances the operation was performed solely as a palliative procedure because of impending obstruction.

Technic.—If one can determine in advance that the contemplated resection will not be attempted at the initial operation, there is an advantage in making a left rectus incision which centres on the umbilicus. This permits subsequent entrance into the abdominal cavity through a right rectus incision, unhampered by possible infection of the primary wound. Otherwise a right rectus incision is made in the first instance. The liver and aortic glands are first palpated to determine the presence or absence of gross metastatic implants, and finally the growth and the lymphatics adjacent to the containing portion of bowel are visualized when possible, then palpated. The latter manœuvre should be conducted with considerable circumspection and great gentleness. Timidity here is far more a virtue than is boldness since should an abscess be present, one may very easily and unsuspectingly insert a finger into it. Moreover, the spread of infection from primary growth throughout the peritoneal cavity by the examining hand because of the number and virulence of the organisms in and about the growth is an easily demonstrated danger.

The terminal portion of the ileum about ten to fifteen centimetres from the ileocæcal valve is brought into the wound. Ordinarily it will be found necessary to tie but a few of the terminal branches of the mesenteric vessels just before they enter the intestinal wall. By avoiding the larger vascular branches and therefore disturbance to the circulation of the bowel, the technic is simplified and time is saved in that the necessity for removing a segment of bowel is eliminated. In order to secure as large an opening in the intestine as is possible the special clamp is applied to the ileum at about an angle of 45°. (Fig. 1.) A Payr, or any other suitable clamp, is applied distal to the first and as close to it as is possible and the bowel between them is divided with a cautery; the end

toward the cæcum is invaginated and dropped back into the abdomen, to be removed with the colon at subsequent resection. A point is now selected on the anterior surface of the transverse colon, ordinarily at about the juncture of the proximal and middle thirds unless the growth is at the hepatic flexure, in which case a more distal point is chosen. (Fig. 2.) Allis forceps then are applied to the colon sufficiently far apart to assure an opening comparable in size to the diameter of the ileum and with these forceps elevated the selected segment of colon is fixed by the free blade of the special clamp, one blade of which already contains the proximal portion of ileum. The elliptical piece of colon which protrudes above the closed blade of the clamp is removed with cautery, leaving the cauterized edges of the two pieces of bowel occupying positions exactly opposite each other. (Fig. 3.)

The clamp and the mobility of the bowel permit easy manipulation in establishing the anastomosis. The clamp is now turned completely over making the handle point away from the operator so as to bring the posterior side of the bowel into view. (Fig. 4.) This permits accurate approximation of the peritoneal coats of the bowel on the under surface of the anastomosis, because here the two arms of the bowel are in juxtaposition. A continuous suture (our preference is chromic catgut to which a curved needle is welded) is employed and it is tied at one end and locked at the other; the two ends are left long in order that the ends of the anterior suture may be tied to them after removal of the clamp. The clamp is now turned back to its original position and starting with a new suture (this should be an invariable rule) the anterior line of suture is applied by means of a continuous Cushing stitch which passes over the upper surface of the clamp; ties are not made at either end at this stage since to do so would defeat the purpose of this inverting type of suture. (Fig. 5.) Preparations are now made for removing the clamp. An assistant grasps one of the long ends of the posterior suture in order to steady the bowel, and as the operator withdraws the clamp, the blades of which have been opened slightly, the assistant draws his end of the anterior suture taut, thus commencing the process of inversion. When the clamp has been completely withdrawn, the operator draws his end of the anterior suture taut and in this manner completes the

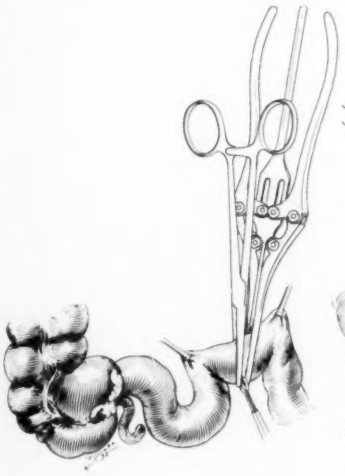

FIG. 1.

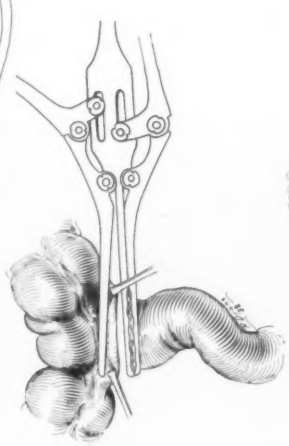

FIG. 2.

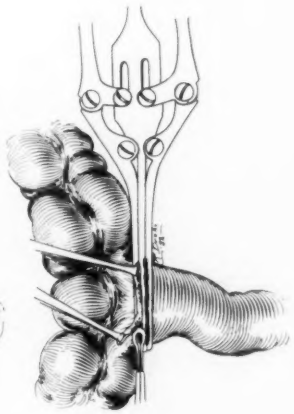

FIG. 3.

FIG. 1.—Application of clamp to ileum. The blood supply in the mesentery has been tied off and the special clamp is applied at an angle so as to obtain a wider lumen for the anastomosis. The bowel is divided with cautery.

FIG. 2.—The clamp is shown being applied to a point selected on the transverse colon for the colonic end of the anastomosis.

FIG. 3.—An elliptical portion of the colon is being removed by cautery to make an opening in its lumen and the small bowel is shown approximated at this point.

inversion. The agglutination of the two ends of the bowel under the steady pressure keeps it intact as this manœuvre is carried out. Leakage at this stage has not occurred in any of our cases. The two ends of the anterior suture are now tied with the corresponding end of the posterior suture. Another layer of sutures, either continuous or interrupted is inserted around the entire anastomosis and tags of fat and omentum are attached at both ends as a precaution against leakage. At this stage it is well to force the wall of the colon ahead of the fingers until the fingers are felt to have passed through the anastomosis, thus to break out the agglutination which forms a diaphragm. (Fig. 6.)

Although we did not establish an enterostomy proximal to the anastomosis in any of our 60 cases, we are cognizant of its potential value under certain circumstances and believe that thorough consideration should be given to its employment in every case. Pringle[6] believes that death in acute septic peritonitis is due to intestinal toxæmia secondary to paresis of the inflamed intestine rather than to absorption of the products of the suppurative inflammation of the peritoneum. Handley[4] and others concur in this opinion.

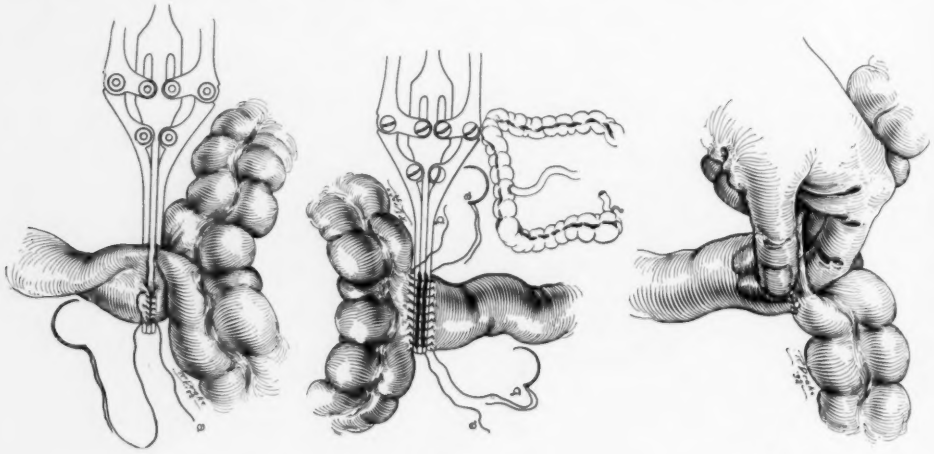

FIG. 4. FIG. 5. FIG. 6.

FIG. 4.—Illeocolostomy over a clamp. Posterior layer of sutures anastomosing the ileum and transverse colon. Clamp is turned over.

FIG. 5.—Ileocolostomy over a clamp. Anterior layer of sutures applied. (a) Posterior suture; (b) anterior suture. Insert shows the operation completed.

FIG. 6.—The fingers introduced through the anastomosis to break up the agglutination which forms a diaphragm.

If this is true, then enterostomy established at the time of operation should prove a sound precautionary measure as regards the probable development of peritonitis. Moreover, enterostomy possesses the very desirable feature of lessening intra-intestinal pressure which might produce undue tension on the line of suture.

The abdominal wound is closed in the usual manner and without drainage. We consider it important in these cases always to insert a rectal spool or rectal tube, which is left in place, except for cleansing, during the first seventy-two hours in order to prevent an increase in the intracolonic pressure.

The details of the pre-operative and post-operative care of such cases have recently been outlined by Rankin, Bargen and Buie[8] and unquestionably are highly important to comfortable convalescence.

SUMMARY

(1) In cases of carcinoma of the right half of the colon, it is our feeling that aseptic ileocolostomy between the terminal ileum and the transverse colon followed by resection of the right segment at the same stage on a subsequent one is the procedure of choice.

(2) The employment of end-to-side anastomosis rather than lateral anastomosis is urged in this particular instance because of the very desirable feature which the end-to-side method passes over the lateral in sidetracking the fæcal current and allowing as much reduction of local inflammatory reaction around the growth as is possible. Moreover, the end-to-end anastomosis more nearly approaches the natural anatomical relationship of ileum to cæcum.

(3) A technic which employs the use of a special clamp, the results of which have been recorded in sixty cases, is described in detail.

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TRANSACTIONS

OF THE

PHILADELPHIA ACADEMY OF SURGERY

STATED MEETING HELD APRIL 3, 1933

The President, Dr. John Speese, in the Chair

Calvin M. Smyth, Jr., M.D., Recorder

OSTEITIS FIBROSA CYSTICA GENERALIZATA

Dr. George M. Dorrance reported the case of a woman, aged forty-six, first seen in May, 1931, complaining of pain in the right upper jaw, which she stated began a year previous. The pain was distributed to the region of the first right upper molar. Some discomfort was also experienced in he pre-molar area on the upper left jaw. At that time the upper right molar and upper left pre-molar were extracted. Immediately following this extraction the right superior alveolar process began to enlarge. Eleven months later the soft tissues of the right side of the face up to the nose became slightly swollen. At this time, pain commenced in the right ear and right side of the neck; dull intermittent headache was also noticed. There had been no history of pain anywhere else in the body. No fractures, hypotonia, nausea or vomiting. With the exception of a mass on the right side of the neck over the thyroid region which the patient had noticed for the past several years there were no symptoms referable to any other part of the body. The right side of the face was slightly larger than the left. Nasal septum deviated to the right. A symmetrical enlargement involved the alveolus of the right superior maxilla extending to the side of the hard palate. There was a diffuse, smooth swelling on the right side of the neck. The rest of the physical examination was essentially negative.

X-ray examination of the teeth and alveolar margin revealed a definite erosion of the upper right alveolus below the maxillary antrum, involving an area of three centimetres in length and two centimetres in depth between the second molar and bicuspid. This area was fairly well circumscribed and contained many small bodies of the density of enamel, scattered irregularly throughout the area. The röntgenologist stated that there was a mass the consistency of bone projecting from the right maxilla downward and outward, one centimetre in diameter, outline of which is regular. The skull—the anteroposterior view here showed little change. The lateral view showed an area in the right fronto-parietal region of decreased density, rather sharply outlined, which stereoscopically appeared to be destruction of the inner table. This measured seven centimetres horizontally and nine centimetres obliquely. X-ray studies of the entire bony skeleton revealed only a peculiar rounded shadow of increased density in the lower third of the left femur. Blood calcium on successive days was 10.95 and 11.01 milligrams per 100 cubic centimetres of blood.

Operation, June 5, 1931, the alveolar margin and tumor were excised. *Pathological Report.*—Osteitis fibrosa cystica.

The patient improved, but by December the lesion had not completely healed, the anterior part of the scar being reddened and a sequestrum being disclosed. X-ray revealed a similar appearance to that previously described.

A second operation was performed April 4, 1932, when the alveolar margin was removed up to the canine tooth. The bone was curetted as long as soft spongy material could be removed, leaving a smooth solid surface. The pathologist again pronounced the condition to be osteitis fibrosa cystica. On July 6, a small reddened area on the lateral aspect of the right upper jaw was evident. The patient complained of some soreness. In view of the fact that there were areas of decalcification in various bones, it was suggested that the tumor in the neck be removed to determine whether it was thyroid or parathyroid. Therefore, July 7, a colloid cystic mass, the size of a small peach, was enucleated. Search for a parathyroid adenoma or enlargement was unavailing. The pathological diagnosis was colloid goitre.

September 13, 1932, X-ray studies revealed some remaining calcium deposit about the lesion on the right side but no spread. Up to February, 1933, the patient felt perfectly well, but a check-up on the blood calcium revealed that it was 19.2 milligrams per 100 cubic centimetres and the blood phosphorus 2.1 milligrams per 100 cubic centimetres of blood. It was decided to give X-ray therapy over the parathyroid area. After six weeks the blood calcium dropped to 12.01 milligrams per 100 cubic centimetres of blood. X-ray studies at the present time show the alveolar margin to have been removed. Skull—There is an increase in the original process in the fronto-parietal region in all directions by two centimetres. There is no X-ray evidence of any other bony lesion except the left femur, the exact nature of which is undetermined and in which there has been no increase in size. The patient is being maintained under observation and further studies will be made.

Dr. DeForest P. Willard said, regarding a similar case in which the calcium was rather high and the blood phosphorus low, that with a high-phosphorus diet containing considerable viosterol, the patient's condition greatly improved. The X-ray pictures during the last month showed a great deal of recalcification without any parathyroid or thyroid treatment. There has also been a large improvement in the decalcified area of the skull.

ALCOHOLIC INJECTION OF GASSERIAN GANGLION FOR TIC DOULOUREUX

Dr. George M. Dorrance reported the case of a man, aged thirty-two, who thirteen years ago had four abscessed teeth in the right inferior maxilla. The second molar was extracted at that time. Following this extraction he continued to have pain and subsequent X-ray films showed a number of abscesses. Then all the abscessed teeth on the right side of the jaw were extracted. This was followed by osteomyelitis. Two months following this extraction the pain was very severe. Although a chlorazene mouth wash was instituted, his condition did not improve. Some time later a solution of potassium permanganate to his gums was substituted, under which treatment the gums healed and he had no further pain for about three years.

In 1923, he developed exquisite pain in the right lower jaw. In December of that year he went to the Evans Institute for treatment and they referred him to the Neurological Clinic at the University of Pennsylvania Hospital. He was admitted to the hospital where he remained for four weeks. During this time the pain was so severe that he was given hypodermic injections which he thinks were morphine. At this time, he states, Doctor Frazier injected his nerve with alcohol. This is taken to mean the nerve at the foramen ovale. He had relief from pain for four years after this injection.

In 1927, he again began to have pain for which he consulted an osteopath, who under chloroform anæsthesia treated his "cervical and thoracic nerve regions." He had a number of treatments which gave complete relief for a long time. Four years ago he developed a right-sided tic douloureux principally in the third division. An attempt to inject the nerve did not obtain any relief. The surgeon then trephined the mandible and avulsed the inferior dental nerve. Following this the patient had marked relief for a year, at the end of which time the entire inferior dental canal was opened up. At the angle of the mandible were found the root of a tooth and a small neuroma. Following this the patient had complete relief until September, 1932, when the pain recurred principally in the tongue and over the anterior part of the ear.

When first seen by the reporter, he had typical symptoms of right-sided tic douloureux principally in the third division.

On October 15, 1932, by the Hartel method, Doctor Dorrance injected the ganglion and obtained anæsthesia over the entire distribution of the fifth nerve. He now has anæsthesia over all three branches. He has had no difficulty with the cornea nor any return of pain.

The reporter agreed with W. Harris, of London, that the results of the ganglionic injection are so satisfactory as to justify its use in tic douloureux, and for pain in malignant disease. He even goes so far as to say no case should be operated upon that can be injected.

Dr. Charles F. Nassau said that although Doctor Dorrance was probably right in his individual case, unfortunately it is not true that injection of the gasserian ganglion with alcohol is without danger. There have been a number of accidents. Even in the hands of very good men, loss of vision has occurred. These injections almost always have to be repeated. Why not give the patient the benefit of permanent cure by operation? However, as Professor Kocher said in speaking of cholelithiasis, "Gall-stones first of all belong to the patient and then to the surgeon," but they are the patient's to keep if he so chooses. The speaker believed that such patients should be referred to that brain surgeon whose work shows the most perfect post-operative results. It is not an operation to be attempted by the general surgeon.

Doctor Dorrance said that when he first began injecting the second or third division of the fifth nerve outside the skull, he heard the same objections as Doctor Nassau now made. The men who made these objections are now injecting the nerves. There are a large number of patients who refuse to have the major operation. This was one; the speaker has had about fifteen others. The patients have been sent to him because they refused to have the major operation and none of the terrible consequences which Doctor Nassau mentions has occurred. We ought to be able to inject a certain number of these ganglia. Dandy approaches the division of the root of the fifth nerve in one way, Frazier in another and Cushing still divides the entire root. Surely in certain cases of malignancy injection is the method of choice and the results have been satisfactory. In cases of tic douloureux, if the surgeon were as skilled in injecting the ganglion as in performing the operation, there would be many more injections.

MELANOTIC SARCOMA OF SMALL INTESTINE

Dr. Eldridge L. Eliason reported the case of a woman, sixty-two years of age, who was admitted to the Medical Ward of the Hospital of the University of Pennsylvania August 6, 1932. For seven months prior to admission she had been suffering from pain in the mid-abdomen. The pain was

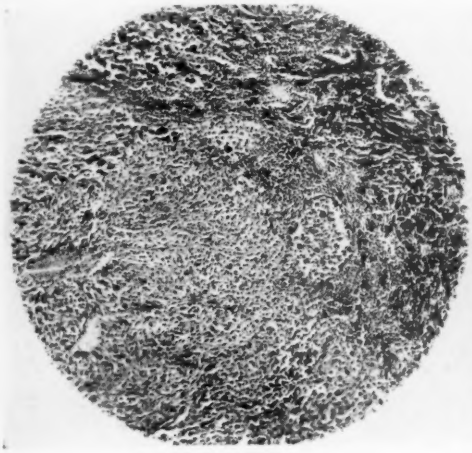

Fig. 1.

Fig. 2.

Fig. 1.—Melanotic sarcoma removed from inner aspect of left thigh October 27, 1930, two years prior to resection of polypi. Magnified fifty-seven times.
Fig. 2.—Jejunal polyp. Melanotic sarcoma. Low-power magnification.

sharp, continuous and had been increasing in severity. Vomiting occurred two days prior to admission, although much of the food consumed had been retained. There had been a gradual loss of weight, from 150 to 120 pounds.

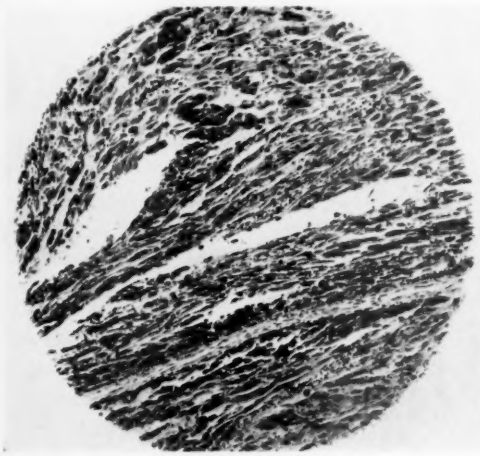

Fig. 3.

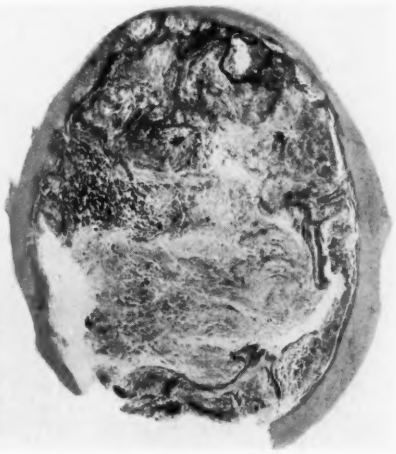

Fig. 4.

Fig. 3.—Jejunal polyp. Melanotic sarcoma. Magnified fifty-seven times.
Fig. 4.—Mesenteric metastasis. Low-power magnification.

Five months prior to admission, March, 1932, the patient had been thoroughly studied at Mt. Sinai Hospital, at which time the above complaints had been of rather brief duration. The patient had had a tumor removed from the upper and inner aspect of her left thigh October 27, 1930. (Figs. 1, 2,

3 and 4.) The tumor had then been present for a year. It was found to be easily movable beneath the skin, unattached to the skin or underlying structures. Section of the tumor showed it to be a melanoma. The patient was an elderly Armenian woman, unable to understand or speak English. Her skin was dark. She was suffering from severe abdominal pain. There was decided evidence of emaciation.

The abdomen was scaphoid, with relaxed, loose, striated skin. There were no scars. Slight fullness below the ensiform suggested an epigastric mass. Peristalsis was not visible, and barely audible. The presence of an epigastric mass was not confirmed by palpation. There was epigastric tenderness, the site of the abdominal pain. There was no muscular resistance. No fluid was demonstrable. There was a flat, pigmented mole on the external aspect of the right leg. A scar in the left groin marked the site of previous tumor excision. The remainder of the physical examination was without importance.

Laboratory Data.—Complete blood counts, urine, blood Wassermann, Van den Bergh, blood sugar, and fractional gastric analysis after test meal, all disclosed findings within normal limits. Graham-Cole gall-bladder studies disclosed a non-functioning gall-bladder. Chest X-ray showed an advanced fibrosis of both upper lobes evidently due to tuberculosis. Stools examined after meat-free diet repeatedly showed the presence of occult blood.

Gastro-intestinal X-ray series showed a deformed duodenal cap; there was some deformity in the second portion, with stasis due to some obstacle. The duodenal loop was wide, possibly due to a pancreatic lesion. There was small intestinal stasis throughout due to peritoneal irritation, such as metastases from malignancy.

The œsophagus, stomach and colon were negative.

Operation.—Under ether anæsthesia, the abdomen was explored through an upper mid-line (linea alba) incision. When the first portion of the jejunum was examined, several tumors were palpable within its lumen. The mobility of these walnut-sized tumors within the lumen of the gut suggested a polyposis. Within the proximal three or four feet of the jejunum about five or six of these tumors were encountered. Two were found to have produced a puckering of the serosal surface of the gut, through complete, though subserous, involvement of the gut wall. At one point, a partial intussusception had occurred.

Examination of the mesentery of this loop of jejunum revealed a nodule near the root of the mesentery, the size of a walnut, the pigmentation of which suggested a melanotic sarcoma. This tumor did not appear to be a lymph-gland, nor were there other lymphatic glands in the immediate neighborhood.

Because of the extensive involvement of the small gut in a patient of advanced years, a simple procedure was elected for the relief of obstruction. A lateral anastomosis was performed, uniting the jejunum proximal to the first tumor, to the ileum beyond the level of the last tumor. The anastomosis was so planned that two of the polyps were removed by simple ligation of their bases. (Fig. 5.) The small tumor in the mesentery was enucleated. The patient made an uneventful convalescence and was discharged September 13, 1932, nineteen days after operation. Gross and paraffin sections of the two polypi and the tumor of the mesentery disclosed them to be melanotic sarcomata.

Through the courtesy of the Mt. Sinai Hospital and Dr. Moses Behrend, sections of the tumor removed from the left thigh were made available for comparison with those of the polypi and mesenteric tumor. They appeared to be the same.

Follow-up Reports.—In February of 1933, approximatey seven months after operation, the patient was ambulatory, with a complaint of constipation. Tumefactions were palpable within the abdomen. She had completed rather extensive X-ray therapy. She was visited recently (March 28, 1933) and found to be bedridden, with abdominal pain, obstipation and vomiting.

The reporter added that sarcoma of the small intestine is a clinical curiosity. The literature is replete with numerous papers on tumors of the small intestine, few of which record melanotic sarcoma. Libman,[11] in 1900, collected forty-two cases of sarcoma of the small bowel, and called attention to Treves'[22] case reported in 1899, a melanotic sarcoma of the ileum, with infiltration of the inguinal glands.

Douglas,[7] in 1912, reviewed the literature on sarcomata of the small intes-

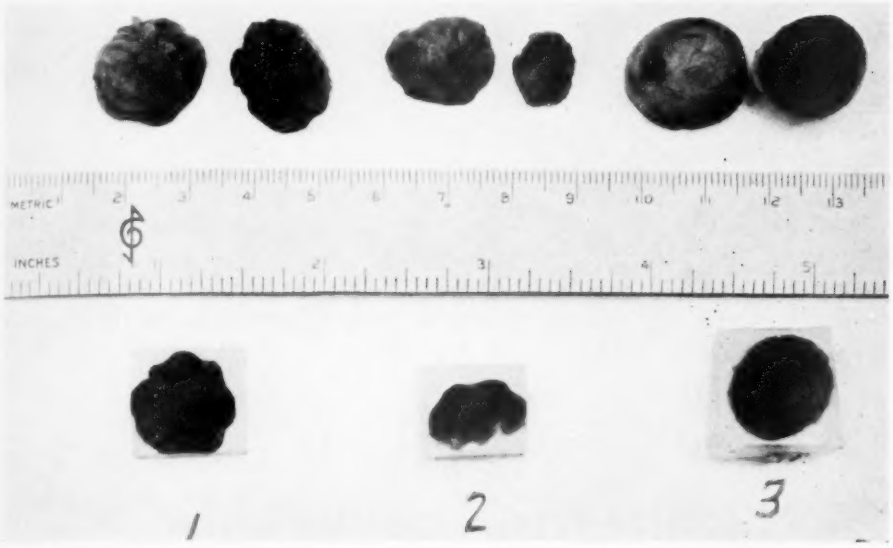

FIG. 5.—1 and 2 are the polypi removed from the jejunum. 3 is the mesenteric tumor.

tine and called attention to forty-nine cases, one his own. No melanotic sarcomata were recorded. Crowther,[5] in 1913, collected a series of 170 cases of sarcomata of the intestines, of which the majority were of the round-cell, lymphosarcoma or spindle-cell type. Five melanosarcomas were observed. Speese,[19] in 1914, collected 101 instances of sarcomata in the small intestine, in ninety-nine of which the type was recorded. One melanotic sarcoma was observed. Chalier and Bonnet[3] compiled 100 cases of primary melanomata of the rectum, and commented that generalized metastases in the intestinal tract was observed only three times, and then only at necropsy.

Haggard[10] quoted a series of 21,000 autopsies, in which sarcomata occurred but three times in the small intestine. Goldstein,[9] in a comprehensive review of the literature up to 1921, collected 130 cases of supposed primary sarcomata of the small intestine. A case of melanotic sarcoma reported by Wilner[24] was mentioned.

Raiford[15] recently reviewed the material of the Johns Hopkins Hospital, consisting of 11,500 autopsies, and 45,000 specimens from the department of surgical pathology, and collected but eighty-eight tumors of the small intestine. Malignant tumors of the small intestine comprised 4.9 per cent. of all the gastro-intestinal tumors. Eighteen and one-tenth per cent. of the eighty-eight tumors of the small bowel were carcinomata, while 2.3 per cent. recorded two cases of lymphosarcoma of the ileum. Melanotic sarcoma was not mentioned.

Cave,[1] concurrently, collected fifteen cases of tumors of the small intestine from the records of the Roosevelt Hospital in New York City, and recorded two cases of lymphosarcoma of the ileum. Melanotic sarcoma was not observed.

Moir and Walker[14] reported three cases of sarcoma of the small intestine, and, from a review of about 200 cases in the literature to date, noted that histologically the round-cell sarcoma, lymphosarcoma and the spindle-cell sarcoma occurred with about equal frequency, while there was an example of almost every sort of sarcoma on record. They concluded that essentially three types of tumor growth occurred. The first type tumor arose from the mucosal surface, and projected into the lumen of the gut as a polypoid mass. The second involved the bowel wall as an extensive tubular or cuff-like infiltration. The third type dangled from the peritoneal surface of the bowel as a pedunculated mass.

The above case is of unusual interest, for it represents an example of the first type tumor, and was proven to be a melanotic sarcoma.

Nine additional cases of melanotic sarcoma of the small intestine have been collected, exclusive of the single cases reported by Treves[22] and Wilner.[24]

(1) Vander Veer and Kellert.[23]—Female, aged fifty. Seven months prior to her death she had coughed up a piece of tissue which was found to be possibly sarcomatous. She had suffered from abdominal distress for four weeks, following which laparotomy revealed an intussusception, the reduction of which revealed a tumor mass which filled the entire lumen of the bowel. The section of the ileum bearing the tumor was resected. Recovery was tedious. She died six months later from what appeared to be an extension of the growth in the lungs. No autopsy.

Examination of the specimen disclosed a polypoid tumor mass projecting into the lumen of the bowel from the mesenteric border. The tumor was flat, irregularly circular, black in color and rather firm. The surface was rather smooth, uneven, grayish-black and covered with mucus. The cut surface was deep black, smooth and structureless. The growth appeared to involve the muscle coats, but did not extend to the serosa. Section proved the tumor to be a melanotic sarcoma.

(2) Thomsen[21] (reported by Vander Veer and Kellert) reported a case of very extensive metastases to the small intestine secondary to a melanotic sarcoma of the big toe.

(3) Rolleston[17] (reported by Vander Veer and Kellert) noted the presence of numerous polypoid tumors in the small intestines, secondary to a growth in the right eye. They were small and resembled mucous polypi

The growths appeared to start in the mucous membrane, the larger ones occupying the mucous and submucous coats. In this case there were metastases to all the abdominal organs and the bones. The liver weighed sixteen pounds. Microscopically, the tumors were spindle-cell sarcomata.

(4) Cox and Sloan.[4]—Male, aged fifty-four. Necropsy disclosed a tumor mass situated about thirty centimetres below the pyloric orifice, and extensively infiltrating the serosa with pigmented tissue for a distance of twenty centimetres. There was no obstruction. The bowel wall was diffusely thickened with the tumor tissue. The mucosa was densely infiltrated, and for a distance of eight centimetres was completely replaced by tumor tissue, showing slight ulceration. There were a few distinct tumor nodules in the mucosa outside this central area of dense infiltration. The lymphatics were all involved. The mucosa of the small intestine showed occasional small pigmented spots, the largest of which were ulcerated. Fifty centimetres below the main mass, one ulcerated nodule of the mucosa was two centimetres in diameter.

It was assumed that the tumor mass arose in the jejunum, with infiltration of the adjacent lymphatics and mesenteric lymphatic nodes; extensive secondary involvement of the liver, gastric and intestinal mucosa, pleura, peribronchial lymph-nodes, heart muscle, brain and the left lung; posterior lobe of the hypophysis cerebri and infundibulum, the peritoneum, vesical mucosa, dura, pericardium, the skull, with slight infiltration of the pancreas, peripancreatic and hepatic lymph-nodes, with occasional metastases in the kidneys, with but one small subcutaneous metastases.

(5) Saphir.[18]—Male, aged fifty. A melanotic sarcoma had been removed from the region of the right nipple two years prior to death. Autopsy revealed a fungating mass in the proximal jejunum, situated opposite the mesenteric attachment and occupying almost the entire intestinal lumen. The tumor was of soft consistency, dark gray, showing a large amount of black pigment. The surface was ulcerated. The tumor involved the mucosa, submucosa and muscularis. Two smaller tumors in the ileum were of a similar nature. Secondary metastases were observed in the lymphatics, liver and the brain.

(6) Maxwell.[13]—Male, aged fifty-two. Three years prior to admission the patient had a mole removed from the right arm. After six weeks of abdominal distress, laparotomy revealed a tumor in the ileum, which was resected. On section the tumor was found to be fungating into the lumen of the gut. The surface was ulcerated. It did not invade the peritoneum. Section showed it to be a malignant melanoma.

Two months later the patient was again operated upon and found to have an intussusception in the ileum, apparently the result of a pedunculated tumor, which was removed. Its character was exactly similar to the tumor previously observed.

(7) Robb.[16]—Woman, aged twenty-three. Three years prior to her death a tumor had been removed from the left groin, which was well encapsulated. On section it was black and microscopically proven to be a melanoma. There was a melanotic mole on the calf of the leg. Sixteen months prior to death, abdominal distress made its appearance, and a tumor mass became palpable. Laparotomy and necropsy showed the whole circumference of the wall of the second and third parts of the duodenum to be occupied by a melanoma. The lumen was enlarged and lined by the necrotic surface of the tumor. At no point did the growth penetrate the peritoneal coat of the duodenum. Its upper and lower limits were heaped up and sharply defined. No other metastases were found.

(8) Robb.[16]—Male, aged sixty. He had a pigmented mole removed from behind the right ear ten years prior to admission. Nine years previously a large mass of glands had been removed from the right side of the neck. He was admitted with vague abdominal complaints, and examination disclosed an orange-sized mass in the abdomen. At operation the mass was found to occupy the jejunum, sixteen inches from the duodenojejunal flexure. No metastases were discovered in the mesenteric lymph-glands or liver. The patient died sixteen days after resection. Autopsy was not permitted.

Examination of the specimen showed the jejunum to be involved by a pigmented growth occupying the whole circumference of the wall of the gut. The lumen was enlarged, and lined by the surface of the growth, which at no point penetrated the peritoneal coat. Microscopically, the tumor was a melanoma.

(9) Lund.[12]—Male, aged fifty. The patient had suffered abdominal distress for about six weeks. There was a marked loss of weight. Laparotomy revealed two intussusceptions due to two tumors, which on section were found to be melanomata on the mucosal surface of the gut. There was noted a soft tumor overlying the pancreas, retroperitoneal, which suggested the primary source. The skin and eyes were grossly negative.

Lund cited a second case, the necropsy of which showed widespread melanotic sarcomata, with none, however, within the lumen of the gut. The primary source had been in an eye, which had been enucleated eight years prior to death.

Dawson,[6] in an extensive treatise entitled "The Melanomata," most thoroughly discussed the morphology and histogenesis of these pigmented tumors. Ewing[8] believed that the melanomata arose from the mesoblastic chromatophores; from epithelial cells which had taken on pigment function. They may exhibit carcinomatous and sarcomatous structures, or both. The primary tumor is usually in the skin, the choroid, iris, conjunctiva, pia mater, arachnoid, rectum and less frequently other organs. Cooke[2] investigated the primary lesions in fifty-three cases of malignant melanomata and found that in over 50 per cent. of the cases the skin was the first offender. Interestingly enough, but one case was listed as being primary in the jejunum.

Saphir[18] believed that one should regard with suspicion a report of primary melanotic sarcoma of the small intestine. Lund[12] quoted Mallory who stated that he had never seen a melanotic sarcoma of the small intestine, except those secondary to tumors of the skin or of the rectum.

It would appear that the case reported by Cox and Sloan[4] might possibly be primary in the gut, but it is to be recalled that, at necropsy, there was a small subcutaneous metastasis. The tumor removed primarily in our own case was subcutaneous.

The symptomatology and diagnosis of the small intestinal tumors have been thoroughly covered in the extensive papers of Speese,[19] Moir and Walker,[14] Struthers,[20] and most recently by Cave.[1]

Lund[12] demonstrated by the X-ray a small intestinal stasis in his recorded tumor. It was this finding that led to the suspicion of small intestinal metastases in our own case.

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CONGENITAL NON-PARASITIC CYST OF THE LIVER

DR. ELDRIDGE L. ELIASON reported the case of a female child, aged three years and nine months, who was admitted to the Hospital of the University of Pennsylvania, December 11, 1932, on account of a lump in the right side of the abdomen. (Fig. 6.)

The child had been perfectly well until she developed a mild pyelitis four weeks prior to admission. Examination by her physician had revealed a tumor mass in the right upper quadrant. The child had been examined frequently during her first year and her physician was positive that, during that time, there was no abdominal tumor present, at least to palpation. She recovered from the pyelitis, but during the four weeks preceding admission there seemed to be a slight increase in the size of the mass, and there was an occasional complaint of abdominal pain, though not severe. Except for pus in the urine, there had been no urinary-tract symptoms. There was no jaundice, nor were there clay-colored or tarry stools. Past medical and family history appeared to be of no importance. She was a well-developed, well-nourished child over three years of age, alert, intelligent and unusually coöperative. The abdomen contained a tumor mass which occupied the greater part of the right upper quadrant. It was smooth, insensitive, rubbery in consistence, and without evidence of demonstrable fluctuation. The liver, spleen and kidneys were not palpable.

Graham-Cole gall-bladder studies did not show any of the dye in the gall-bladder, which on this evidence was concluded to be non-functioning. (Fig. 7.) None of the films showed a gall-bladder shadow which would have been due to the dye, although there was an ample amount of dye in the intestinal tract. On the right side there were three definite shadows. One was evidently the kidney, the other one the liver, and the third, unidentified, was thought possibly to be a large gall-bladder. (Fig. 8.)

The intravenous urogram showed the kidney pelves, calices and ureters

FIG. 6.—Röntgenogram showing small intestinal stasis and probable filling defects.

to be distinctly visible in the fifteen-minute examination, on which evidence the kidneys were considered to be separate from the tumor mass.

The pre-operative diagnosis was: massive hydrops of the gall-bladder, due to a congenital defect in the duct.

The abdomen was explored under ether anæsthesia December 12, 1932. A large cystic mass was exposed and found to occupy the under surface of the liver, extending upward between the two lobes in the region of the central fissure. (Fig. 9.) The cyst was thin-walled and about the size of a grape-fruit. On rotation of the cyst and liver, upward, the normal, blue, thin-walled gall-bladder could be seen to its outer side. The cystic and common ducts were plainly visible. The cyst was first evacuated and found

to contain about 400 to 450 cubic centimetres of clear, watery fluid. The sac was then freely opened and found to be lined with what appeared to be a pale epithelium. A cleavage plane was made out between the lining and the outer coat or capsule. The entire cyst was enucleated from its capsule, following which the outer coat was closed at the neck, about a soft cigarette drain. (Fig. 10.)

Convalescence was uneventful, with the exception of a persistence of the pyelitis. The drain was removed nine days following operation, and on the

FIG. 7.—First röntgenogram taken after absorption of the dye for the Graham-Cole gall-bladder study. Arrows point to the outlines of the cyst.

eleventh post-operative day the child was discharged in good condition. The wound had closed completely. Four months after operation she has gained five pounds in weight and is without complaint.

The fluid from the cyst was carefully examined. The specific gravity was 1.0095. The pH was 5.0 plus. There were a few fat droplets present, with no fatty acid crystals. A few cholesterol crystals were present. There was no hæmatoidin. Fibrin, white blood-cells and bile pigment were absent. There were but few red blood-cells (probably a result of evacuation). The albumen content was 494 milligrams per cent.,

while the sugar content was 78 milligrams per cent. A smear and stained specimen failed to show bacteria or ova.

Laboratory Data.—Red blood-cell count: 4,300,000 per cubic millimetre, with a hæmoglobin of 74 per cent. The white blood-cell count was 6,600, with a differential count of seventy-six neutrophiles, nineteen lymphocytes, three large mononuclears, two eosinophiles and six basophiles. The urine was negative except for the presence of a few pus-cells. The fæces showed the presence of bile, but no occult blood.

A paraffin section of the cyst wall showed an inner layer comprising about two-thirds of the thickness of the section, consisting of hyalinized connective tissue. It

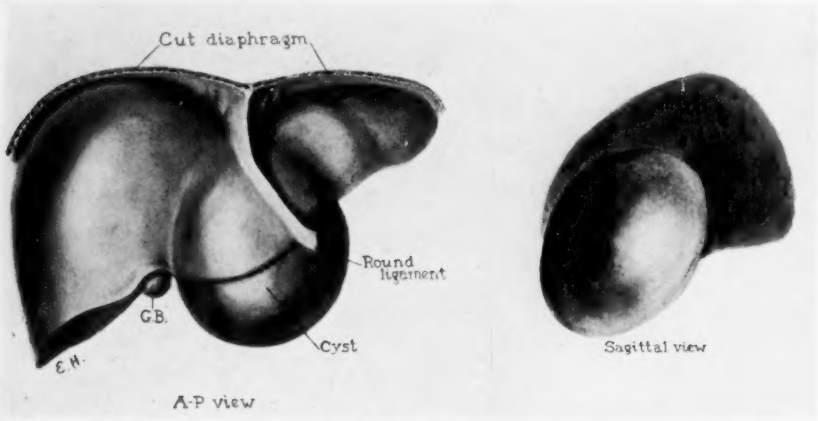

FIG. 8.—Non-parasitic liver cyst, relative position in anteroposterior and sagittal views.

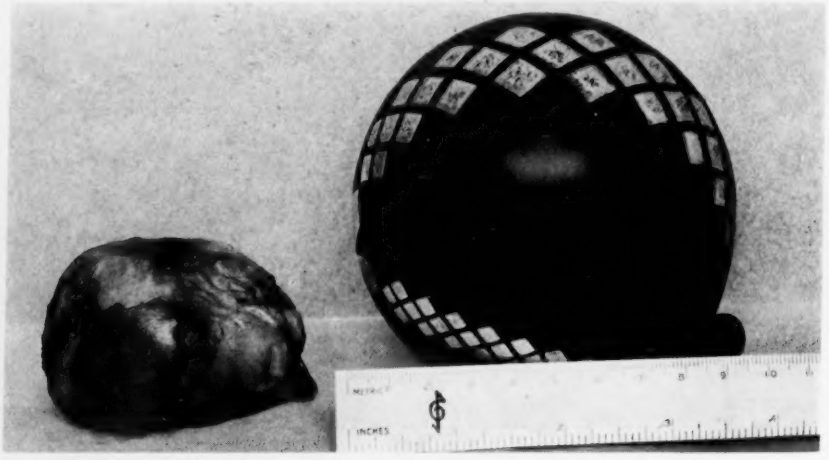

FIG. 9.—The enucleated cyst filled with cotton, compared to a rubber balloon filled with 400–450 cubic centimetres of air, to demonstrate the actual size of the cyst.

appeared that in some areas the inner surface was lined with flattened cells, not unlike endothelia. The outer third of the wall was composed of a matrix of fibrous tissue in which were seen scattered groups of liver cells, an occasional bile capillary and numerous blood vessels. Lymphoid cells were scattered through this tissue layer.

The speaker added that Ackman and Rhea[1] have recently reported a successful operation for what appeared to be a congenital (non-parasitic) cyst of the liver. They referred to the work of Muto and Hanzawa,[3] who had

collected the reports of seventy-five similarly operated cases, sixty-five of which had been recorded since 1900. A few isolated reports of similar cases have appeared in the literature since that time.

The above case is of unusual interest, as were the others reported, because of the speculation as to pre-operative diagnosis, and probable origin of the cyst.

In the papers of McGlannan,[2] and Ackman and Rhea,[1] the following interesting points are worthy of note: Most of the solitary cysts are found growing from the under surface of the liver, extending to the anterior border of the liver in the region of the gall-bladder.

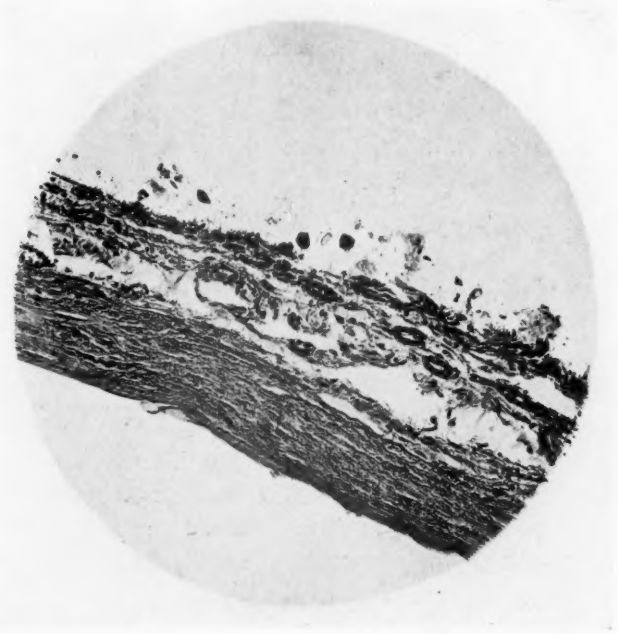

FIG. 10.—Cyst wall magnified 100 times.

The condition is more common in females, the proportion of incidence between sexes being about 4 to 1. Most of the patients are between forty and sixty years of age.

Clinically, a positive diagnosis is difficult because the solitary cysts of the liver had no signs or symptoms sufficiently characteristic to make a pre-operative diagnosis certain. The common diagnoses were: chronic cholecystitis, hydronephrosis, mesenteric cyst, ovarian cyst and tuberculous peritonitis. In the recorded case the pre-operative diagnosis was "probably enormous hydrops of the gall-bladder." A diagnosis of liver cyst was not entertained. The gall-bladder function was undoubtedly interfered with by the cyst, although a follow-up Graham-Cole study has not been made.

Ackman and Rhea point out that in general the effect of the non-parasitic cysts on the condition of the patient depends upon the extent of functional

derangement produced in the liver and the organs about the cyst as a result of pressure.

Considerable divergence of opinion exists among writers on this subject as to the origin of these non-parasitic cysts. In all probability the majority are of congenital origin, such as lymphatic cysts, blood-vessel cysts, ciliated epithelial cysts, cystic degeneration of the liver and kidneys, bile-duct retention cysts and teratomata. The acquired type would comprise the degeneration cysts, cystadenomata and bile-duct cysts associated with acquired cirrhosis of the liver.

McGlannan favored the origin of the single cysts from aberrant bile-ducts or cystic adenomata developed from the same source. Due to the accumulation of the secretion under varying degrees of tension, the lining and secreting cells became imperfect and their secretion was not likely to be true bile. He pointed thus to the impracticability of determining the exact origin of these large solitary cysts by a study of the structure of the wall or the chemical composition of the contents.

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BISECTION OF THE ISTHMUS IN THE PERFORMANCE OF THYROIDECTOMY

DR. JULIAN JOHNSON, by invitation, remarked that as in all matters of taste, so in matters of technic, every one has his preferences. Sometimes the latter are the result of habit, sometimes of an intelligent effort to acquire the best. It is surprising how in little ways there are so many variations in the performance of a thyroidectomy.

In the past at the thyroid clinic of the University Hospital, in the mobilization of the gland the initial step was taken at the superior pole of the right lobe; the lateral aspects and the inferior pole were then liberated and lastly the isthmus was bisected. For the past two years these steps have been reversed so that now Doctor Frazier, as his initial step, bisects the isthmus in sections from below upward. While this procedure has been described by Crile,[1] we feel that it has not received the recognition and use which it deserves. Richter[2] also has advocated bisection of the isthmus but following the liberation of the superior poles. It has been our experience that if the isthmus is bisected as the initial step, the liberation of the superior poles is made much more simple. The procedure requires no special instrument or clamp. With a stock hæmostat the isthmus is separated (Fig. 11) section by section from the trachea, grasped on either side with Kocher hæmostats and the intervening tissue divided. (Fig. 12.) This is repeated until the isthmus is bisected. Sometimes it may be difficult to distinguish the lobe from an enlarged isthmus, but a large branch of the inferior thyroid vein approaching

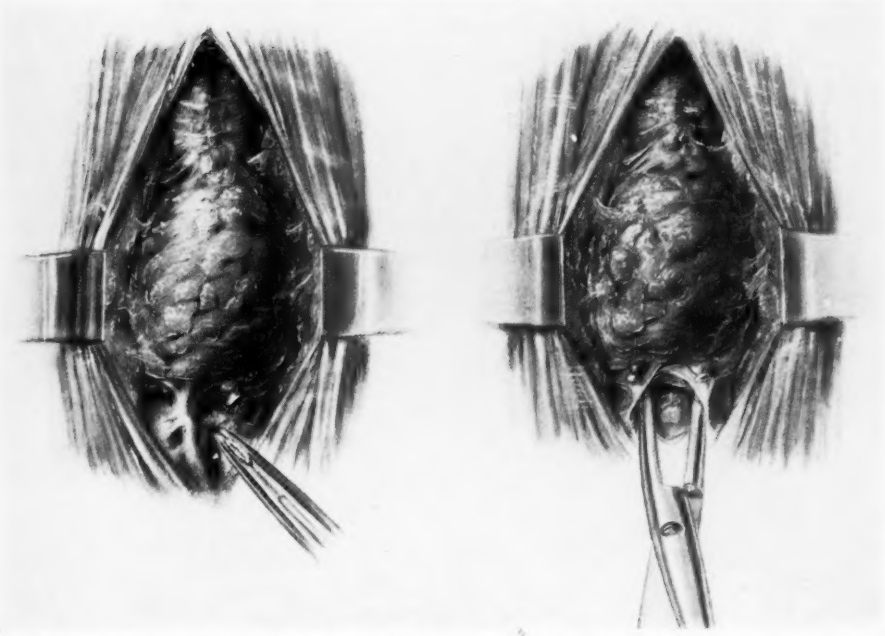

FIG. 11.—(*Left.*) The hæmostat grasping the divided branch of the inferior thyroid vein, the guide to position of the trachea. The fellow vein to the left is undivided. (*Right.*) The initial step in the exposure of the trachea with a stock hæmostat.

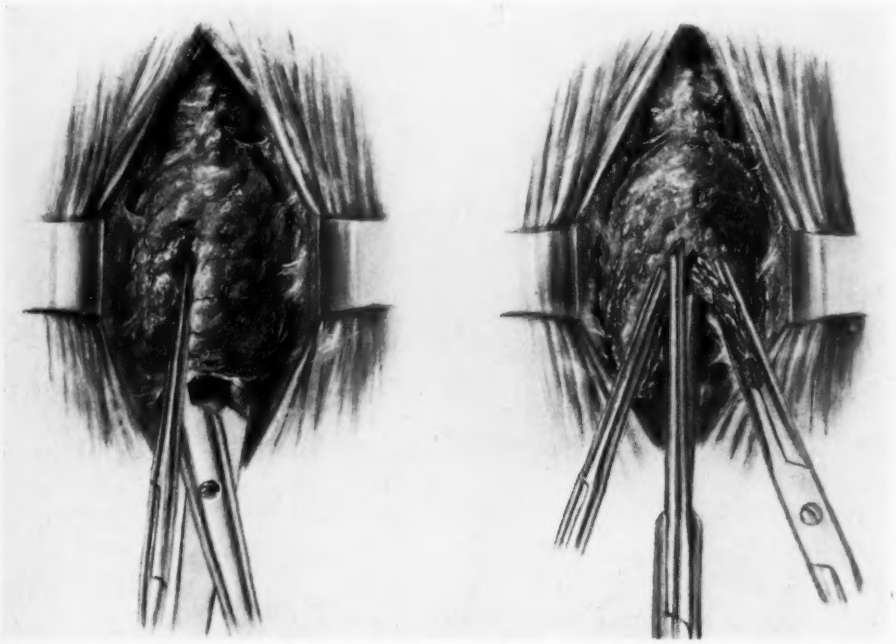

FIG. 12.—(*Left.*) First section isthmus separated from trachea and Kocher applied. (*Right.*) Two Kocher clamps applied to the first section of the isthmus with division of same.

the lobe on one or the other side of the trachea serves as a useful guide. When the isthmus has been bisected, the tissue intervening between the trachea and the superior pole which usually includes the pyramidal lobe is divided. (Fig. 13.)

This method of attack has simplified the performance of the operation to an extraordinary degree; it simplifies the exposure of both the superior and the inferior poles and later the resection of each lobe. Once we believed the exposure of the trachea predisposed to a tracheitis, to mucous collections and to coughs. We are now convinced that this deserves no consideration.

FIG. 13.—Division of isthmus continued section by section. Only small portion remains.

There are conditions in which this preliminary exposure of the trachea by bisecting the isthmus is not practical. This is notably so in large asymmetrical adenomatous masses with substernal extension and marked displacement of the trachea. The trachea is so far below the surface and often so displaced to one side or the other that its exposure as the initial step of the operation is not feasible. Under these circumstances it is our practise to begin the exposure at the superior pole, gradually to displace the mass downwards and mesialwards, following as our anatomical guide the sheath of the carotid vessels until the substernal extension has been disengaged.

In a large majority of the operations in this clinic the ribbon muscles are bisected on one side. To this there are many advantages, especially if one

recognizes the importance of a dissection of the superior pole into its component structures.

We discontinue the gas anæsthesia as soon as the vessels of the superior pole have been tied and at the same time the head is elevated somewhat from its hyperextended position. Both steps are taken for the protection of the recurrent laryngeal nerve. Elevating the head restores to more nearly normal the relation of the trachea, the inferior pole and the nerve. When the anæsthesia is discontinued consciousness is soon restored and the patient will talk or cough on command.

In the next step, mobilization of the inferior pole (which in its conformation is really not a pole as one may speak of the superior pole), the patient is asked to count or cough to give assurance that the recurrent laryngeal nerve is intact. We once believed that this assistance or precaution could be disregarded by the experienced operator. We have changed our minds, and now believe that the more experience the operator has had the more precautions he welcomes.

In this clinic very much more attention is paid to hæmostasis now than in the past and with this we have noticed a much lower percentage of wound complications. The electro coagulating unit is used for control of all minor sources of hæmorrhage. Thus much time is saved, much less ligature material buried in the wound and a much "drier" wound is the result.

The longer and the wider our experience in goitre surgery, the more attention we are paying to minutiae of technic, to the niceties of neat surgical dissections, and to the tidiness of a dry and carefully reconstructed operative field.

Dr. Frederick Bothe said the only question as to this type of approach to thyroidectomy is the ability to control hæmorrhage as satisfactorily. Not infrequently great difficulty is encountered in controlling hæmorrhage at the junction of the lateral lobes with the trachea. The lateral approach is very satisfactory as the greater part of the blood supply has been controlled before this area is reached.

Dr. Charles F. Nassau said that the division of the isthmus as the first step in doing partial lobectomy has been used for many years by a number of operators. It is not a new method but it does facilitate the removal of goitre.

Dr. Benjamin Lipshutz said that the operation of thyroidectomy is essentially an anatomical one. He has carefully looked over many dissected thyroid glands with particular reference to the superior and inferior laryngeal nerves. Concerning injury to the superior laryngeal nerve in the ligation of the superior thyroid artery, it is to be borne in mind that the division of the superior laryngeal nerve into its external and internal branches may occur at different levels and it seems safer to ligate the superior thyroid artery close to the upper pole of the gland or better still to include a tiny piece of superior pole in the ligature. Similarly, much variation exists in the anatomy

of the inferior laryngeal nerve, it may pass behind the inferior thyroid artery, in front of it, or it may divide into a number of branches, which embrace the artery. Regarding the division of the isthmus, Richter, of Chicago, has described a technic of thyroidectomy that fulfills the conditions of safety and requires a minimum of ligature material. He utilizes as the initial step of thyroidectomy ligation of both superior thyroid arteries. Guthrie, in 1926, wrote a paper wherein he advised the ligation of both superior thyroid arteries as the initial step in all intrathoracic goitres and in a number of the speaker's cases this procedure facilitated the mobilization of the thyroid gland. Richter also advises the division of the isthmus as an important step in the operative technic of thyroidectomy.

SPINAL ANÆSTHESIA

Dr. John Paul North (by invitation) read a paper with the above title.

NATURAL FISTULAS BETWEEN THE GALL-BLADDER AND THE COLON

Dr. Thomas A. Shallow, and, by invitation, Dr. Sterling McNair, reported the case of a spontaneous biliary fistula existing between the gall-bladder and the hepatic flexure of the transverse colon. The patient was admitted to Jefferson Hospital in June, 1925, when she was fifty-two years of age. She complained of pain in the right upper quadrant of the abdomen in the region of the liver and gall-bladder, but at times she had generalized abdominal pain. She had never had typhoid fever, or other serious illness except indigestion for the past twelve years. Her present illness began in the middle of November, 1931, with sudden sharp abdominal pain, generalized in character but more particularly involving the right upper quadrant. Following the onset of the pain, she vomited large quantities of bile for several days, which was followed by a moderate amount of relief. Two days after the onset of her trouble she became jaundiced. The jaundice was progressive and, at the time of her admission, was marked. Her temperature at the time of admission was 100.4°; pulse, 108; respirations, 26; leucocyte count, 23,000; and she was in a stuporous condition.

Physical examination was essentially negative except for the abdomen. There was rigidity in the right upper quadrant, associated with tenderness. The rigidity was limited to this area and not associated with any generalized abdominal disturbance. A diagnosis of cholangeitis in a uræmic patient was made and operation not recommended. The patient died two days following admission. Autopsy was limited to the abdomen.

The hepatic flexure of colon and part of the omentum were densely adherent to the liver around the gall-bladder region, forming a distinct mass. The spleen weighed 340 grams and was quite adherent to surrounding structures. The œsophagus and stomach were normal. No lesion was observed in the small intestine. The ascending colon at the hepatic flexure was densely adherent in two places to the fundus of the gall-bladder, causing a distinct kink in the colon. These adhesions were so dense that they had to be separated with a knife. At the site of the adhesions there was an opening where the gall-bladder and colon communicated. The opening was approximately one centimetre in its greatest dimension. The remainder of the colon was normal. The liver was markedly enlarged, very soft, flabby and friable and on section cut with ease. The liver substance in areas seemed to be broken down. The larger bile-ducts were distended with a

dark greenish yellow, purulent material. Just beneath the capsule on the left lobe of the liver on the upper surface were several small areas containing pus. The gall-bladder was thickened, contracted and did not contain any bile, nor could stones be demonstrated. The hepatic duct contained a large stone. The common duct, although enlarged, was patent. The cystic duct was obliterated and no evidence of a patent communication between the gall-bladder and liver could be demonstrated.

DOCTOR SHALLOW remarked that the frequency of biliary fistula from gall-bladder to colon is shown in figures submitted by Roth, Schroeder and Schlott. In 10,866 necropsies performed, internal biliary fistula was found forty-three times; of this number nineteen were between gall-bladder and duodenum and sixteen gall-bladder and colon. In the ANNALS OF SURGERY, 1925, Judd and Burden, of The Mayo Clinic, report 153 cases of internal biliary fistula operated upon. Of these 117 were between gall-bladder and duodenum, four between gall-bladder and duodenum and colon, four between gall-bladder and stomach and twenty-six between gall-bladder and colon. One hundred and eleven were female, forty-two male, the greatest number were in the sixth decade of life, and the symptoms had been present from one month to forty years, with an average of ten years. Most of these patients had symptoms of gall-bladder disease. Of these 153 cases, the diagnosis was made negatively in only two, both of which were of the type extending from gall-bladder to colon. Of the cases reported where the fistula extended from the gall-bladder to the colon, the most common site was at the hepatic flexure.

This case is unusual in that there was no bile in the gall-bladder, nor in the fistulous tract, nor in the colon, and that the cystic duct was obliterated, although the common duct was patent, and, although the patient had symptoms of gall-bladder disease for the past six years, she was fairly well until the three days before admission, when the stone in the hepatic duct lodged so securely that no bile was able to enter the common duct and duodenum.

In the literature, the speaker found another interesting case in connection with the above which shows that with an internal biliary fistula between the gall-bladder and duodenum there may be no gastro-intestinal symptoms and that the health may not be impaired to any extent. This case is that of a man, aged 81 years, who was admitted to Jefferson Hospital December 16, 1931, with frequency of urination, nocturia, dysuria and retention of urine. This patient had never had any symptoms relative to gastro-intestinal tract. He died after four days and autopsy showed cause of death as: Prostatic hypertrophy, Chronic cystitis, Acute suppurative pyelonephritis. During the course of the autopsy there was discovered a biliary fistula extending from the gall-bladder to the duodenum, the tract was patulous. No evidence of gall-bladder disease nor any lesion of stomach was seen.

DR. DAMON B. PFEIFFER recalled the case of a woman over seventy years of age upon whom he operated about a year ago, who had both a communication between the gall-bladder and colon and gall-bladder and duodenum. She had a long-standing history of gall-bladder indigestion. After repair of both fistulæ and a cholecystectomy she made a good recovery.

DOCTOR SHALLOW said that the autopsy showed a fistulous tract between the gall-bladder and the transverse colon. The cystic duct was entirely obliterated. There was a stone in the hepatic duct. We all know the serious-

ness of anastomosis between the gall-bladder and the transverse colon because of the almost certain result of ascending infection into the ducts of the liver. But in this case, Nature was able to combat by blocking in the cystic duct, the ascending infection. This woman died of cholangeitis, secondary to a stone in the hepatic duct.

The time of the anastomosis can be definitely placed as six years before her death. At that time she was employed in one of our large hospitals and was under the care of some of the best men in this city. The diagnosis made at that time was carcinoma of the liver. This was based on the presence of a mass, assumed to be an enlarged liver, without any of the manifestations of gall-bladder disease. Contrary to the natural fistula formed between the gall-bladder, stomach or duodenum, which is fairly common, the anastomosis between the gall-bladder and transverse colon is relatively infrequent.

STATED MEETING HELD OCTOBER 2, 1933

The Vice-President, Dr. Walter E. Lee, in the Chair

Calvin M. Smyth, Jr., M.D., Recorder

ABDOMINAL ANEURISM

Dr. Hubley R. Owen reported a case of extensive abdominal aneurism, extending from below the diaphragm to the bifurcation of the iliacs, in whom, treatment by ligation or the use of a metal or fascial band being impossible, the aneurism was treated by wiring. The man, aged forty-eight years, was admitted to the Philadelphia General Hospital April 1, 1933, on account of abdominal pain. His personal and family history were essentially negative and in no way suggestive of lues.

In the abdomen extending from the upper left epigastrium down toward the course of the aorta to the left lower quadrant there was a large mass, which practically filled the middle third of the abdomen. An expansible pulsation was present over this mass and a bruit was heard on auscultation.

He remained in the hospital ten days, when he was discharged because surgical intervention seemed inadvisable. Eight days later he was re-admitted because of continued abdominal pain, increasing in character. X-ray April 3, 1933, as follows: "There is a large somewhat circumscribed dense shadow in the abdomen, extending from the second to the lower margin of the fourth lumbar vertebra, extending more to the left. Fluoroscopically, it was very difficult to visualize any pulsation in the mass. In the lateral view there appears to be a somewhat smooth concavity of the second and third lumbar vertebræ. The remaining vertebræ appear normal. Heart is enlarged in its transverse diameter. Hypertrophy of the left ventricle. Widening of the arch of the aorta. Lung fields normal."

Laboratory examinations were essentially negative.

Operation.—Under ether anæsthesia, a right rectus incision was made from the ensiform cartilage to the umbilicus. The intestines were packed to the side, exposing a large thick-walled saccular type aneurism extending from the diaphragm to the bifurcation of the iliacs. The mass measured

six inches long by three inches wide. The right iliac could be traced making its exit from the lowermost portion of the aneurism. The left iliac also made its exit more posteriorly but could not be felt in close proximity to the tumor. The thinnest portion of the sac was at its lower pole. Expansible pulsation was marked. The transverse colon was attached to the mass above. Ten cubic centimetres of blood were aspirated with a small Luer syringe. A cannula was inserted into the mass and blood was ejected in spurts. Gold wire to the extent of six feet was inserted into the aneurism and an electric current passed through the wire for a period of forty-five minutes, the current ranging from a minimum of five milliamperes to a maximum of forty-five milliamperes. Cannula was withdrawn. Bleeding readily checked by pressure and abdomen closed.

April 22, 1933, the systolic blood-pressure was 122, diastolic 84. The patient made an uneventful recovery from his operation and was discharged May 10, 1933.

He was returned to the care of his family physician until September 7, 1933, when he reported for observation. On that date his condition was much improved. He had gained 10½ pounds in weight and had had very little discomfort from abdominal pain. An X-ray examination made September 8, 1933, showed approximately eight or ten loops of wire lying in front of the lumbar vertebræ and extending from second to fourth, inclusive. No part of aneurismal sac is demonstrable by fluoroscopical examination, although on the film it appears to extend to left slightly beyond border of left iliopsoas muscle line. There is apparently no change in the erosion of anterior surface of bodies of third and fourth lumber vertebræ.

During his convalescence he has been taking large doses of potassium iodide. If his symptoms return it is expected to repeat the procedure of wiring.

PEPTIC ULCER RUPTURING THROUGH CARDIO-ŒSOPHAGEAL JUNCTION INTO PLEURAL CAVITY

Dr. Irvin E. Deibert reported the case history of a man, aged fifty-three, who was admitted to Cooper Hospital in the service of the reporter, January 19, 1933, complaining of severe epigastric pain. Upon admission he was somewhat stuporous, pulse very rapid and thready, respirations thirty-eight per minute, temperature 100°. His face was somewhat cyanotic, expressive of severe pain, left chest tympanitic, breath sounds somewhat distant, heart sounds very rapid and weak. The abdomen was slightly distended but very rigid over the entire epigastric area. The extremities were somewhat cyanotic. Otherwise the examination was negative. The diagnosis of perforated ulcer was made and operation deferred with the thought that the patient might possibly react to supportive treatment; however, his condition became rapidly worse and he died eight hours after admission. An autopsy was done with the following conditions revealed.

The abdomen when opened was apparently normal with the organs *in situ*. The thorax when opened had a decided fecal odor and a large quantity of dark brown fluid was observed in the left chest; fifty-two ounces of this fluid were removed and it was then found to be seeping from a perforation in the peri-œsophageal tissues about 1½ inches above the diaphragm; the œsophagus and stomach were removed together and section of the stomach revealed a large ulcer at the cardiac opening of the stomach not in œsophageal tissue.

The heart, pericardium injected apparently from external irritation, fatty, slightly enlarged, vegetations on the mitral, aortic and tri-cuspid cusps.

Aside from an enlarged adherent thickened gall-bladder which contained several large stones, the remainder of the examination was about that of the average individual of this type and age.

The past history of this patient is as follows. He was always a very healthy individual, no serious illnesses or operations. About a year and a half ago he began to complain of digestive disturbances and was studied with the thought that he was suffering from gall-bladder disease. X-ray studies at that time were negative as to gall-bladder disease or ulcer. These films have been reviewed since the death of the patient and with our present knowledge show nothing in the examination to make one suspect any pathological condition of the gastro-intestinal tract.

The patient's health following the gastro-intestinal study was reported to have been good up to three weeks ago, when he developed an attack of influenza. He was apparently convalescing when a sudden attack of pain occurred about an hour and a half before admission to the hospital.

A study of the literature covering ruptured peptic ulcer has been made and the reporter is unable to find other than one case of this type reported; this was by H. Von Schwartz, Germany, Med. Klinics, 1932. His case was in many respects similar to this.

THYROIDECTOMY IN THE PRESENCE OF COMPLETE BRANCH BUNDLE BLOCK

Dr. Fredrick A. Bothe reported the case of a women, fifty-three years of age, who was admitted to the Presbyterian Hospital, September 12, 1929, with the chief complaint of loss of weight, tachycardia, nervousness and fatigue. She was perfectly well until January 6, 1929, when she had a slight attack of influenza accompanied by fatigue, general listlessness, and headache. She was confined to her home for two days, but the fatigue and general listlessness persisted. Ten days later she began to be nervous and the ankles swelled. Subsequently she developed bronchitis and was confined to bed for two weeks. After recovering from this illness she noted that her heart beat very rapidly, and she was very short of breath. In the meantime, the nervousness had become progressively worse. In June, 1929, palpitation developed and she was always fatigued. The above symptoms gradually became more severe, accompanied by a progressive loss of weight, and she was practically confined to bed before admission to the hospital.

When admitted, the essential physical findings were: a moderate loss of weight; nervous, restless, and very active mentally; pulse 120 and regular; the eyes showed slight widening of both palpebral fissures, Stellwag's and von Graefe's signs negative; ocular movements normal; thyroid gland moderately enlarged in the isthmus and right lobe, irregularly nodular and fairly firm. There was a visible pulsation of the right external jugular vein, with a pulsating systolic thrill. No bruit was heard over the thyroid gland, a systolic murmur was transmitted to the vessels of the neck. There was a visible pulsation in the second interspace on each side of the sternum. The heart beat was forcible but no thrill could be palpated. To percussion there was slight enlargement. A rough pre-systolic murmur could be heard at the apex which was transmitted to the axilla. A soft blowing murmur

was heard at the xyphoid. The basal metabolic rate was plus 48. A teleoröntgenogram showed moderate enlargement of the heart. An electrocardiogram showed a partial right bundle branch block. The blood Wassermann was negative. There were no other laboratory findings of any significance. *Diagnosis.*—Toxic adenoma of the thyroid with partial right bundle branch block.

The patient was given the usual pre-operative treatment for toxic adenoma. One week after admission the basal metabolic rate had fallen to plus 33. She improved clinically but did not become stabilized until twenty days after admission. At this time the basal metabolic rate was plus 3. A second electrocardiogram showed a complete bundle branch block. In view of the stabilized condition of the patient and believing that the toxic adenoma was responsible for the progressive myocardial changes, a thyroidectomy was performed under novocaine anæsthesia. The patient stood the operation well and reacted favorably. On the fifth post-operative day the pulse was down to 80. The convalescence was somewhat prolonged but uneventful. She was discharged from the hospital twenty-two days after operation. A number of electrocardiograms were made subsequent to operation which demonstrate the disappearance of the branch bundle block. The improvement which they show immediately after operation illustrates how favorably the damaged myocardium may react subsequent to thyroidectomy. All evidence of failing compensation disappeared, the patient's strength gradually improved and she promptly returned to her normal weight. It is now four years since the operation, and there has been no evidence of failing cardiac compensation. The pulse rate is normal (80) and the patient is able to do clerical work. The dyspnœa has entirely disappeared with the exception of two occasions when she was walking on the street against a very strong wind. Both times she developed cardiac embarrassments, and was confined to bed for several days. She is able to indulge in moderate exercise with no bad effect.

Electrocardiographical studies made before and after operation illustrate both the untoward effect a toxic adenoma has upon the myocardium, and the improved condition of the myocardium subsequent to thyroidectomy.

BILATERAL PULSATING EXOPHTHALMOS

Dr. Fredrick A. Bothe reported the case of a woman sixty years of age who was admitted to the Presbyterian Hospital January 24, 1933, with the chief complaint of frontal and occipital headache and swollen and protruding eyes. The patient was perfectly well until three days before admission when she fell down stairs striking the back of her head and left shoulder. A large lump developed on the back of the head and there was slight bleeding from the left nostril, which she thought came from the back of her throat. No drainage occurred from the ears. She was dazed but not unconscious. In twenty-four hours she began to notice the eyes becoming more prominent, and she developed severe conjunctivitis with chemosis of both lower lids. At the same time she began to suffer from frontal and occipital headaches. These conditions became progressively worse. Twenty-four hours before admission she noticed a roaring sound in the head, which was situated above the left ear. A gradual failing of vision developed, more marked in the right than in the left eye. Nausea and vomiting occurred twenty-four hours before admission.

When admitted she complained of a roaring noise in her head, and a severe headache. There was large hæmatoma over the left parietal region, and a distinct depression could be palpated at its borders. On auscultation over the cranium a definite bruit could be heard over both temporal regions and the mid-portion of the forehead. It was heard best over the left temporal area. The pulsation of the left carotid artery was controlled by compression with the thumb over the transverse process of the sixth cervical vertebra, but this did not completely obliterate the bruit. Compression of the right common carotid pulsation did not diminish the bruit at all. X-ray of the skull was negative for fracture. Examination of the eyes showed bilateral exophthalmos of moderate degree accompanied by pulsation. Right lid ptosed and could not be raised. Conjunctivæ very injected and protruding between the lids. There was very slight outward rotation, and hardly noticeable upward or downward movement, and no inward rotation. No involvement of conjunctive, no inward or outward rotation, but slight upward and downward motion. The pupils are equal and respond well to light. Ophthalmoscopical examination showed media clear in both eyes, discs normal in color and outline. Arteries bright and somewhat irregular. There is a pronounced bruit, synchronous with the pulse, which is heard over each eye, louder over the right, suggesting arteriovenous communication between the internal carotid artery and the cavernous sinus. An examination of the heart revealed no enlargement, the sounds were of poor quality but the rhythm regular.

The chemosis of the lids became progressively worse, that of the right being extreme. The headache and disturbance from the bruit became more pronounced. Ten days after admission the conjunctivitis and chemosis of the lids progressed to such an extent it was very difficult and painful to open them. The audibility of the bruit remained the same as noted above. Fifteen days after admission compression of the left common carotid artery was started, the pulsation being compressed about one minute. By this time the chemosis of the left eyelid had increased considerably. Daily compression was practiced, carefully observing for any sensory or motor changes on the opposite side of the body, and obliteration of the bruit. The length of compression was gradually increased until it could be continued for thirty minutes without any untoward development.

Six weeks after admission, the patient was operated upon under local anæsthesia. The left common carotid artery and its bifurcation into the internal and external carotid arteries were exposed. To obtain a good exposure it was necessary to ligate and cut the superior thyroid artery. Clamps were placed on the common, external, and internal carotid arteries and the blood expressed between the clamps. The clamp on the internal carotid artery was released and blood flowed into the obliterated space between the clamps. The blood was then expressed from the space between the clamps and the clamp was then reapplied on the internal carotid artery. A similar procedure was carried out with the clamps on the external and common carotid arteries. The only time the bruit was completely obliterated was when the common carotid was clamped. As soon as the clamp was loosened on this artery the bruit returned. The blood-pressure was being taken in the course of the operation. When the bruit was obliterated there was no fall in blood-pressure, and no motor or sensory changes occurred on the opposite side of the body. The clamp was left on the common carotid artery, a ligature carried beneath the artery but not tied. The wound was

left wide open and a loose dressing applied. The patient was carefully observed for eight hours for any evidence of change in the blood-pressure or signs of motor or sensory changes on the opposite side of the body. During this time the patient did not hear the bruit and it could not be heard by auscultation. She was then taken to the operating room again and the double ligature was tied tightly around the common carotid artery and the wound was closed with one piece of gauze for drainage. The clamp was left *in situ* for eight hours before ligating the vessel as it could easily be removed had the patient developed any evidence of cerebral softening. This type of operation was developed by Dr. George M. Dorrance and it was at his suggestion that the reporter used it. The patient thought she faintly heard the bruit on several occasions during the first few weeks after operation but has not heard it since. At the time of the operation she was only able to distinguish light from dark in the right eye; the vision in the left eye was impaired about 40 per cent. Subsequent to operation the œdema of the lids, conjunctiva and chemosis slowly improved and the ocular movements likewise returned. At the same time there was a gradual improvement in the vision of both eyes.

Four months after operation, there was slight chemosis of the right lower lid which has been present for four days prior to that time. She stated that the condition of the conjunctiva was practically normal. The vision in her left eye was almost normal and that of her right eye had improved about 70 per cent. and was still improving. She had developed several corneal ulcers in the left eye during convalescence.

Dr. George M. Dorrance said that he had seen this case with Dr. Bothe who ligated the superior thyroid and the common carotid artery. Approximately 50 per cent. of the gross reflux from the external carotid comes through the superior thyroid artery. In this operation the speaker ligates the common carotid; several days or a week later, he ligates as many of the branches of the external carotid as necessary to make the bruit disappear. In most cases, it is essential to ligate the common carotid artery, the superior thyroid and as many other branches as necessary to cut down the volume reaching the internal carotid. One important point is that in ligating these arteries it is wise to drain the wound in the presence of gross mouth or nose and throat infection. We were taught not to do it but most of the surgeons in the World War found that if one ligated the external carotid for a hæmorrhage in the mouth, and failed to drain, infection frequently occurred and following this secondary hæmorrhage from the ligation wound.

Dr. Thomas A. Shallow said that he has proved conclusively in a case which is on record that after the ligation of the common carotid artery pulsating exophthalmos is not cured in all cases. The reason for this is not, as Doctor Dorrance intimates, the establishment of a collateral circulation by the superior thyroid arteries, but it is due to a reversal of the flow of blood along the common carotid artery from the circle of Willis down to the point of ligation.

Dr. George M. Dorrance rejoined that the first time he ligated the common carotid artery the bruit did not disappear. Later he ligated the branches of the external carotid up to the internal maxillary and the bruit did disappear. It has been shown that if one excises the carotid bulb, then sutures the cut ends of the external and internal carotid together, the circulation will flow from the external into the internal. This phenomenon of the flow of the blood down the external carotid into the internal carotid after ligation of the common carotid has been observed by many others, including Matas, so there can not be much doubt of the truth of the observation.

SUPERIOR LARYNGEAL NERVE AND THE SUPERIOR POLE IN THYROIDECTOMIES

Dr. William H. Erb, by invitation, read a paper with the above title.

Dr. Charles Frazier said that by preventing accumulation of mucus in the trachea patients have been more comfortable. In evidence he called attention to the fact that three years ago he purchased a half-dozen special atomizers for use in the goitre ward. The atomizers are not there any more! That seems to be proof positive that the mucus has disappeared. If one looks at the specimen it will be seen how intimate are the branches of the superior laryngeal nerve with the superior thyroid artery. Prior to the adoption of the present technic a hæmostat was passed under the whole pole and the blades sufficiently separated to put on two larger hæmostats and divide the pole between them. It is now known that it is absolutely impossible to make a mass ligature of the superior pole without injuring the external branch and possibly the internal branch.

ETIOLOGY OF INDIRECT INGUINAL HERNIA

Dr. Maxwell Cherner (by invitation) read a paper with the above title for which see p. 577.

Dr. Benjamin Lipshutz remarked that this study represents the continued observations of many years. It is not merely based on dissections of fifty consecutive cadavers. Observing the numerous anatomical variations year in and year out led to a more intensive survey of their relative frequency. Similar results follow the careful study of any anatomical structure. There is an ideal anatomy, but there is no ideal body. Departures from normal are constantly encountered. This study is here presented purely from an anatomist's viewpoint, and is not meant to have any clinical application. It applies probably with the same degree of accuracy to the direct, as well as to the indirect hernias, for a direct hernia is essentially a blowout of the tissues. Some years ago the speaker was interested in the muscle variations of the inguinal region and began such a study on

a number of old, well-defined hernias. In very old hernias the inguinal canal is largely obliterated, since the internal and external abdominal rings tend to approximate each other. Thus no conclusion can be drawn from evidence obtained in large, well-defined hernias. The study must be carried out mainly on the very early types of hernias and the muscle variations compared with similar observations on cadavers free from any signs of hernia. In the present state of this study, it will be wiser not to attempt to draw any practical conclusions concerning its relation to the operative repair of the different types of inguinal hernia.

TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY

STATED MEETING HELD OCTOBER 11, 1933

The President, Dr. Allen O. Whipple, in the Chair

VALUE OF MULTIPLE DRILL HOLES IN THE TREATMENT OF NON-UNION OF FRACTURED FEMUR

Dr. John V. Bohrer presented a boy who was admitted to the children's surgical service, Bellevue Hospital, August 29, 1931, with a history of an automobile accident September 11, 1930, in which he sustained a fracture at the junction of the middle and upper thirds of his right femur. He had been admitted to a hospital and operated upon for his fracture. This resulted in non-union. Apparently there was no fixation of the fragments in this operation, but there was end-to-end approximation.

When admitted to Bellevue Hospital he was a well-developed boy of nine years, normal in all respects except the deformity of his right leg. The right femur was sharply angulated at the junction of its upper and middle thirds. There seemed to be fibrous union. His right leg was two inches shorter than his left. The diameter of the right thigh was three-fourths inch less than the left. The angulation was such that the foot could not be placed on the floor in a weight-bearing position. There was no nerve injury. He had a five-inch linear scar on the lateral aspect of his right thigh at the level of his fracture. The thigh had the appearance of a bow with the hamstring muscles forming the string. These were markedly foreshortened and atrophic.

X-ray examination revealed an incompletely united fracture at the junction of the middle and upper thirds of the right femur. The fractured ends were in apposition but there was a marked anterior angulation. At the site of the fracture there was sclerosis of the bone, callus formation on the posterior surface, and no bony union. An effort was made to stretch the foreshortened hamstring muscles. A Buck's extension was applied to the lower leg and the thigh muscles were given daily baking and massage for one week. He was then operated upon for reduction of the deformity and a sliding bone graft was done to maintain the reduced position and promote bony union. It was necessary to use screw traction on a Hawley table to overcome the deformity and stretch the taut hamstring muscles.

The previous incision was reopened, the femur exposed, the fibrous union divided and the eburnated ends of the bone cut away in order to secure healthy bone approximation. Using a Moorhead circular saw, a typical sliding bone graft was done. A Buck's extension was applied in order to prevent recurrence of the contraction of the hamstring muscles and a plaster spica was applied for complete immobilization. The patient was given an immediate transfusion of blood and was returned to the ward in fair condition. X-ray two days later demonstrated the fragments in excellent position. The angulation had been entirely reduced. His convalescence was uneventful. He was given a diet rich in calcium and vitamins, to promote the formation of callus. An x-ray taken nine weeks later demonstrated a slight recurrence of the former angulation and a beginning absorption of the bone graft. More weight was then added to the Buck's extension, which had been applied under

the spica bandage. This seemed to prevent further development of the deformity. At the end of twelve weeks the case was removed. An x-ray picture definitely showed that the graft was being rapidly absorbed and, in spite of the extension, the deformity was recurring. Again there was only fibrous union. Due to the location of this fracture it was impossible to apply a walking plaster casing, so, as a substitute for the stimulation obtained from such a procedure, a Mummsen's apparatus, which has been used in this country by Dr. Arthur Krida with good results, was tried. A spica case was applied and the apparatus placed so the trip mallet struck the padded heel of the patient. This simulated the jar of walking but did not stimulate bony union. Four months after the bone-graft operation and subsequent treatment there was still no bony union. Multiple drill holes was then decided upon and the original wound, which had healed by primary union, was partially reopened over the line of the fracture. Twelve 3/16 inch drill holes were made in a criss-cross fashion about the fracture line and a spica case again applied with a Buck's extension on the leg to prevent contraction of the muscles. This casing was removed in three months; bony union had taken place. There was no shortening. At the present time the x-ray still shows slight angulation. His functional result is perfect.

Dr. Fenwick Beekman remarked that in 200 to 300 cases of fractured femur in children he had seen only one or two cases that were ununited and in both the reason was because of the presence of muscle between the fragments. In this case the reduction at the hospital had been complete and the non-union was due to other than mechanical causes. A second point of interest, from the view of the final outcome, was that the cause was large deposits of scar tissue about the site with a certain amount of ischæmia. The treatment by which union was secured, through boring holes in the bones, proves this point. The speaker said he had been interested in the work of Leriche and Policard, who recommended the boring of holes in the bones in bone transplants. If the holes are made in the transplant it gives more room for the entry of blood-vessels. In this case the non-union was due to sclerosis of the vessels in the soft tissue about the fragments and by means of the holes vascularity was increased.

TORSION OF THE OMENTUM

Doctor Bohrer presented a man who was admitted to the Peekskill Hospital, service of Dr. William Martens, February 29, 1932. For two days previous to his admission he had suffered from progressively increasing pain in his abdomen. At first it was a mere discomfort, then generalized abdominal pain which ultimately localized in the right lower quadrant, more acute just below and lateral to the umbilicus. He had never experienced a similar attack. There was no vomiting. His one complaint was pain which was aggravated by being in the erect position.

He suffered from habitual constipation and frequently took Epsom salts but had not taken any cathartic for one week before the onset of pain, and took none at that time. He never was athletic and did not indulge in setting-up exercises. The speaker had operated upon him in 1930 for an œsophageal diverticulum. There had been no other illnesses. He had had a right inguinal hernia for fifteen years and had always worn a well-fitting truss. When in the erect position, without a truss, abdominal contents entered the hernial sac but never became incarcerated, and the hernia always spontaneously reduced when in the recumbent position. Frequently the truss

would become displaced and the hernia protruded; this the patient would reduce by taxis, while in the erect position. He was sixty-eight years old, in fair nutrition but acutely ill. He was not fat and did not have a protuberant abdomen. His general examination was normal except for the surgical condition. His pulse was 96 per minute and temperature 100.5° F. The abdomen was slightly distended. Abdominal breathing was very limited. There was only slight rigidity but marked tenderness in the right lower quadrant, especially below and just lateral to the umbilicus, no palpable mass, moderate tympany, no signs of fluid, on auscultation the entire abdomen was silent. The hernial sac was empty. Blood count was: Hæmoglobin, 85 per cent.; red blood-cells, 4,740,000; white blood-cells, 13,700; with 85 per cent. polymorphonuclears. Urine analysis showed a trace of albumen, no sugar, a few white and red blood-cells.

Operation under spinal anæsthesia disclosed a slight amount of free amber fluid, a normal appendix, an empty right hernial sac and a portion of the right half of the great omentum gangrenous. This gangrenous portion of omentum was attached only by a two-inch pedicle consisting of a medium-sized vein and artery. There were seven clockwise turns of the pedicle. The pedicle was untwisted, clamped, ligated and divided, and the mass removed. The appendix was removed. The abdominal wound was closed in layers without drainage. The hernia was then repaired by the Bassini procedure. The patient made an uneventful recovery except for an acute exacerbation of his chronic bronchitis. This caused a distressing cough which resulted in a weakness of his abdominal wound, but had no apparent effect on his herniorrhaphy. He has remained well and is free of pain. The specimen consisted of a piece of omentum measuring approximately ten by five by one centimetres. The distal one-half of the specimen was blackened and discolored; on section it was homogeneous and black in appearance. The proximal one-half contained some gray streaks and showed a few thrombosed vessels.

Microscopical examination of material removed from the distal portion of the specimen showed marked congestion of arteries, veins and capillaries. There are numerous small hæmorrhages throughout the lobules which separate the fat cells. A section from the proximal portion showed a similar picture with a few areas of fat necrosis and saponification.

Dr. John H. Morris said that recently a large number of these cases had appeared in the literature, suggesting that they may have been overlooked in the past and that the older statistics on this subject are not entirely trustworthy. A large percentage of the reported cases have appeared in the last few years. As to classification, these cases may be simply grouped as (1) torsion associated with hernia. Doctor Bohrer's case falls in this group. The herniæ themselves have certain destructive characteristics: They are scrotal in type; invariably contain omentum; are easily reducible and show statistically an average duration of sixteen years before onset of acute attack of torsion. Most of these cases have worn trusses which may be a predisposing factor. An interesting mechanism has been described to explain how torsion of the omentum is initiated. It has been suggested that the omental content of these scrotal herniæ becomes molded by its long residence in the inguinal canal, so that eventually there is formed a long thin pedicle corresponding to the inguinal canal and a relatively large bulbous extremely corresponding to the scrotum. Repeated attempts at reduction of this mass are said to be responsible for the initiating twist which leads to complete torsion.

This mechanism is held to be analogous to the rotation of the fetal head in the parturient canal. The rotation produced is dependent upon the attempts of the relatively large mass to adjust itself to varying diameters of the inguinal canal.

Torsion associated with hernia is the most common type observed and the omental masses produced are often displaced into the abdomen where they may undergo complete torsion. In these instances the related hernia is held to be the initial etiological factor. It is difficult to differentiate torsion of the omentum which has taken place in the inguinal canal from strangulated hernia. In the latter, however, an obvious point of constriction is apparent, possibly at the internal or external ring. In the former there is no such point of constriction since the circulatory disturbance has been produced by the actual contortions in the neck of the omental mass itself. It is important to make this differentiation since in cases of scrotal torsion, the omental turns may "run up" the pedicle into the abdomen where secondary torsion and gangrene of the omentum may occur. This is the so-called combined type of torsion which requires laparotomy in addition to the treatment of the inguinal canal pathology.

The types of torsion occurring independently of hernia are induced by some type of intra-abdominal pathology such as tumors or cysts occurring in the omentum and acute inflammatory disease which induces adhesion or inflammatory thickening of a portion of the omentum. There is also recognized a traumatic variety in which torsion follows blows on the abdomen or violent muscular effort such as wrestling.

LUDWIG'S ANGINA

Dr. Ralph Colp presented a boy, aged ten, who was admitted to Mount Sinai Hospital April 18, 1932. One week before admission he had developed a swelling of the submental nodes which was progressive. His temperature ranged between 101° and 103°, and he experienced difficulty in opening his mouth and swallowing. When admitted to the hospital he had a temperature of 102.4°, pulse 128, and respirations of 24. He was acutely ill. In the submental region was a swelling which was hard and non-fluctuating; the overlying skin was brawny and œdematous; the mouth was opened with difficulty; the tongue was definitely elevated and fixed and there was some œdema about the frenum but the lateral areas of the floor of the mouth and the submaxillary areas were comparatively free.

The mass was poulticed for twenty-four hours without effect. Then, under general anæsthesia of gas and oxygen, a transverse skin incision was made between the mandible and hyoid; the mylohyoids were separated in the median raphe and a mass of necrotic lymph-glands were extirpated but no pus encountered.

Following the operation the patient did not do well. He became more toxic. The trismus increased and upon forcing the jaws open, the floor of the mouth was markedly œdematous. The submental induration had spread in twenty-four hours to both submaxillary triangles and these were stony hard, the overlying skin being brawny and œdematous. His respirations were stertorous and labored. The condition now resembled a spreading phlegmon of the floor of the mouth; a Ludwig's angina. Radical extirpation of the submaxillary salivary glands to establish drainage was decided

upon. It was felt that inhalation anæsthesia, because of the beginning œdema of the glottis, was unwise, and because of the age of the patient, a boy of ten, extirpation of the salivary glands under local did not seem feasible. Accordingly avertin was given by rectum while the boy was on the operating table. Within three minutes after its administration, the boy became unconscious, markedly cyanotic and ceased to breathe although the pulse remained fair in quality. A low emergency tracheotomy was performed with immediate relief of symptoms and during the subsequent operative procedure, oxygen was introduced through the tracheotomy tube.

The original transverse incision was prolonged laterally down toward the region of the hyoid bone and then up to the angle of the jaw. Upon incising the cervical fascia, the submaxillary salivary glands bulged into the wound. The glands themselves were normal but posterior to them, extending along the mylohyoid, the submaxillary and retromandibular spaces, was thin serous yellow pus. The submaxillary salivary glands were excised and the wounds packed with iodoform gauze.

Following operation, his temperature reached 106°, pulse 146, and his condition was desperate, but a continuous intravenous of glucose and sponging did much to improve him. Twenty-four hours later his condition was markedly better. He was able to swallow more easily, could open his mouth and the œdema of the floor of the mouth began to subside. Within a week his tracheotomy tube was removed, and at the end of ten days his packings. He was discharged on the twelfth post-operative day.

This patient was presented to point out the risk of using avertin anæsthesia in cases in which the rima glottidis has been encroached upon as in an œdema of the glottis. While the narrowed laryngeal opening was sufficient to maintain respiration when the boy was conscious, as soon as deep anæsthesia was obtained, the muscles attached to the larynx became relaxed and asphyxia occurred necessitating tracheotomy. In the final analysis, the only safe anæsthesia in this type of case is local infiltration, and it should be attempted even in children if the occasion demands.

A second point was to emphasize the inadequacy of the so-called DeLorme median incision to adequately drain deep infections of the floor of the mouth. Presumably the process was localized submentally, and although a median incision seemed to drain the focus, progressive suppuration took place, spreading along established fascial planes. This was stemmed only when sufficient drainage was secured by bilateral excision of the submaxillary salivary glands.

Dr. Percy Klingenstein said that there were also types of deep cervical suppurations not included in Doctor Colp's presentation, particularly those resulting from foreign-body perforations of the upper digestive tract, infected malignant lymph-nodes of the neck, or from parapharyngeal abscess as the result of deep lymph-node suppuration. He believed that Doctor Colp was right in stressing the relation of the deep cervical fascia to suppuration in and around the submaxillary gland. The speaker mentioned the surgical significance of another space, the mylohyoid space, which may harbor infection. This had been brought to his attention after watching Doctor Moschcowitz operate upon just such a case as Doctor Colp had presented this evening. After an extensive dissection no pus was encountered until the posterior margin of the mylohyoid muscle was split. It was remarkable how toxic these patients quickly became. The speaker had occasion to operate upon a case recently just ten hours after a canine tooth was extracted. Prostration and evidence of severe constitutional reaction were outstanding.

Dr. Fenwick Beekman said that some years ago the late Dr. Astley Ashhurst, of Philadelphia, wrote a very scholarly article on Ludwig's angina, in which he described the anatomy in detail. He believed the lymphatics were not involved and that it was a true cellulitis: a phlegmon without the formation of pus. The technic of operating upon these cases was by means of incisions and the placing of drains which ran into the mouth in front of the angles of the jaw and behind the symphysis. The speaker had used this method in three cases with success. Doctor Ashhurst believed the asphyxia in these cases was mechanical, due to the tongue being pushed back, and he believed in early tracheotomy.

Dr. Allen O. Whipple stated that using small incisions with probing of the planes and spaces for finding pus carried with it great danger in uninvolved planes and spaces being contaminated where drainage was inadequately established. For this reason he believed that carefully and accurately placed incisions with the spaces and planes in the neck properly exposed gave much more certainty of finding pus and a much more accurate drainage of the spaces involved with freedom from contamination of uninvolved spaces and planes.

Dr. Henry F. Graham said that Ashhurst had emphasized the fact that these infections of the floor of the mouth are dangerous, the mortality being 33 1/3 per cent. The speaker had had two of these cases, after reading Ashhurst's article, and as they both got well, regarded him as too pessimistic; but he decided after the third case that he was right, for the third case died.

In closing the discussion, Doctor Colp said that Doctor Klingenstein's point of dividing the mylohyoid muscle was an excellent one and that he was in the habit of doing this identical procedure in almost all excisions of the submaxillary gland, especially if the uncinate process was a large one. The reason that tracheotomy was done in this case was not because of the dyspnea occasioned directly by the disease, but was due to the closure of the glottis due to the avertin anesthesia. As a matter of fact, since the removal of the submaxillary salivary gland in conditions of Ludwig's Angina, the relief of edema of the glottis has been so immediate that tracheotomy has practically become unnecessary.

He remembered reading Doctor Ashhurst's paper in which no mention was made of the procedure recommended by the author. While it is true that some of these cases unquestionably do well when drained by "through-and-through" drainage, it seems poor practice to drain through the infected areas of the mouth when drainage through the neck properly performed will give excellent results.

In answer to Doctor Hanford, the retromandibular space while potential is bounded anteriorly by the posterior margin of the ramus of the inferior maxilla, and the pterygoid process; posteriorly, by the mastoid process and the transverse processes of the atlas and axis, and superiorly, by the petrous portion of the temporal bone and the cartilaginous part of the external auditory meatus. The soft parts which upholster this region are anteriorly the

superior constrictor of the pharynx, the internal pterygoid muscle, inferiorly the sternomastoid muscle and the posterior belly of the digastric which separates it from the superior carotid triangle.

SUBPHRENIC BILIARY ABSCESS. INCISION AND DRAINAGE OF ABSCESS. CHOLECYSTECTOMY

DOCTOR COLP presented a woman, aged forty-six, who was admitted to Mount Sinai Hospital February 20, 1933. Six years before admission, she had a left nephrectomy for a probable calculus pyonephrosis, and at the same time calculi were also discovered by x-ray in her right kidney. From then on patient was perfectly well until six months before admission when she developed episodes of pain around the region of the umbilicus, associated with epigastric fullness, relieved by vomiting. The pain finally shifted to the right lower quadrant and after twenty hours disappeared. With this attack there were no chills, fever, jaundice or acholic stools. Three months prior to admission, she experienced a similar attack of pain which was associated with vomiting. Within four days she was better. Four weeks before admission she had a third attack, but with this episode the pain radiated to the scapula. Since this last attack she had a dull pain intermittent in character. Upon admission she appeared chronically ill. There was dullness at the right base of the chest with greatly diminished breath sounds. The liver edge was distinctly palpable one finger below the costal margin and beneath this there appeared to be a tender gall-bladder. There was a left nephrectomy scar. The hæmoglobin was 85 per cent.; white blood-cells, 14,400; 85 per cent. polymorphonuclears, blood-pressure, 120/80. The urine showed albumin, a few white blood-cells, but no trace of bile or urobilin. The blood chemistry was normal and the blood Wassermann negative. Examination of the chest by x-ray revealed elevation of the right diaphragm which was about two interspaces higher than the left. The gall-bladder failed to visualize after the administration of the dye. There was no evidence of urinary calculi but it was noted that the third lumbar was widened laterally and possessed a coarsening of the trabeculæ. There was also some general mottling about this vertebra. A pneumo-peritoneum showed a large amount of air in a left subphrenic space which outlined the spleen and adhesions to the abdominal parietes. On the right side, no air was seen below the diaphragm and when the patient was placed in the lateral recumbent position, no air was seen above the margin of the liver. Investigation of the right kidney revealed normal function.

Under local anæsthesia about four inches of the right eleventh rib was excised from the paravertebral line to the posterior axillary line. The pleura and diaphragm were sutured together above and below the line of proposed incision. Upon incising the diaphragm, about a gallon of bile with a mucopurulent quality escaped. The under surface of the diaphragm was covered with hillocks of granulations and the upper surface of the liver appeared normal. The source from which the bile originated could not be ascertained. Culture of the bile grew *B. coli*. The patient ran a smooth post-operative course and drained a moderate amount of bile. Gradually the sinus contracted down to about a half inch and two weeks before discharge, a sodium iodide injection of the sinus showed a large irregular cavity situated high up, probably under the diaphragm. During the last few days of her stay in the hospital, she experienced epigastric pain with radiation to the right upper quadrant associated with vomiting. Her temperature at this time was 102°. It was felt she had another attack of cholecystitis but operation at the time was not advisable and she was discharged to the country for convalescent care. In four weeks the lumbar sinus had closed completely.

While in the convalescent home she had three attacks of umbilical and right upper quadrant pain. She was readmitted June 2, 1933, for cholecystectomy. The operation was performed under avertin anæsthesia, supplemented by gas and oxygen. Through an oblique upper right rectus muscle-splitting incision, the peritoneal cavity was entered; the liver and gall-bladder were obscured by omental adhesions; upon separating these, the liver was found retracted well beneath the costal margin, its upper surface adherent to the diaphragm by fibrous adhesions. The gall-bladder itself was chronically inflamed and thickened, measuring about five inches in length with an average diameter of two inches. It was surrounded by the omentum and the fundus was adherent to the hepatic flexure, and the ampulla to the duodenum by dense adhesions. In the mid-portion of the gall-bladder was a broad band of fibrous adhesions, evidently the point of a previous perforation. The cyst duct was slightly dilated and opened at an oblique angle into the common duct. At the neck of the gall-bladder, a freely movable stone the size of an olive pit was found. The liver itself appeared normal. There were no stones in the common duct.

A typical retrograde cholecystectomy was performed and drainage instituted. The recovery was smooth and the patient was discharged on the fourteenth post-operative day.

The speaker remarked that cases of silent perforation of an inflamed gall-bladder into the subphrenic space are rare and but few have been reported. A careful history failed to elicit the presence of any acute abdominal symptoms although the patient had several episodes of typical gall-bladder colic. Even though there was over a gallon of bile in the right subphrenic space, there was no chest pain, dyspnœa, or cyanosis. Evidently the bile leaking from the perforated gall-bladder accumulated so slowly and so gradually that ample opportunity was afforded for readjustment of the respiratory organs. The single stone in the gall-bladder acted as a ball valve, first allowing the bile to escape through the perforation into the subphrenic space, and then finally slipping back into the cystic duct to obstruct the further flow of bile, thereby permitting the perforation of the gall-bladder to heal.

Dr. DeWitt Stetten said that this presentation not only called attention to the rather rare silent perforation of the gall-bladder, but also illustrated a relatively unusual cause of subphrenic abscess. Perforation of the gall-bladder or suppurative cholecystitis is, at least in the experience of the speaker, very rarely followed by subphrenic abscess. He had found that, if there is a pocketing, it is usually subhepatic in character. The speaker had seen two cases of subphrenic abscess following gall-bladder disease. The first was an elderly man with an extensive subphrenic abscess, apparently originating from the gall-bladder region. It was drained in the usual manner but the suppuration extended into the right chest and the patient finally succumbed to the infection. As an autopsy was not obtained, the suspicion that this subphrenic abscess originated from the gall-bladder was never proven. In the second case the patient had a primary empyema of the gall-bladder and developed a typical subphrenic abscess, which was drained forty days after the primary operation, and was followed by prompt recovery.

ABDOMINO-PERINEAL RESECTION FOR TUBERCULOUS SIGMOID, RECTUM AND PERI-ANAL TISSUES

Dr. John J. Westermann presented a woman, aged forty-five, who was referred to him April 23, 1931. She had been operated upon for a con-

dition simulating hæmorrhoids in 1927. This had followed a period of poor health since the birth of her last child five years previously. Almost immediately following the hæmorrhoid operation, she noticed a severe excoriation about the anus and buttocks which gradually increased in area. There were also recurrent attacks of diarrhœa. There was a gradual loss in weight and onset of general weakness.

On her first admission to the hospital a biopsy was made from the skin of the buttocks, the anal tissue and sigmoid and rectal walls. The microscopical examination of these tissues was as follows: (1) Skin of the buttocks involved in an extensive chronic inflammation with a formation of many discreet tubercles. There were a few typical Langhan's giant cells and endothelial cells forming discreet tubercles. There was comparatively little necrosis. (2) Tissues from the hæmorrhoidal tabs and the rectal wall showed more tubercles typical of the disease. As a whole the lesions were characteristic of tuberculosis. Examination of the sigmoid showed the same lesions.

She remained at the hospital until May, 1931, and then was referred to her physician for local sun-lamp treatments and general hygienic care. She remained fairly well until July, 1932, at which time she began to lose weight rapidly (forty pounds in six months). The lesions about her anus and buttocks became markedly worse, there was complete loss of sphincteric control, continuous diarrhœa and vomiting. She was admitted to the hospital again February 9, 1933, at which time a high left-sided colostomy was done. Following this her diarrhœa ceased and she gradually began to improve, both in general health and in the local condition. She was discharged May 23, 1933, to St. Luke's convalescent home. She was returned from there September 8, this year, having gained thirty pounds. She was in apparent good health. There was a marked improvement in the peri-anal lesions. September 14, an abdomino-perineal resection was performed, removing the sigmoid and rectum from the point of colostomy. This case was presented to the Society as one of interest in connection with Doctor Berry's paper, although she is still convalescent.

TUBERCULOSIS OF THE RECTUM

Dr. John A. McCreery presented a man who was admitted to Bellevue Hospital December 25, 1919. His age at that time was forty-three. His chief complaint on admission was pain in the region of the rectum, increased on defecation. His past history was negative except for the loss of fifty pounds in weight in the previous eight months. Examination showed an ischiorectal abscess which at operation was found to involve both ischiorectal fossæ. Incisions were made on both sides and the wounds packed. He was discharged one week later to the out-patient department and readmitted February 16, 1920, because of persisting purulent discharge from both wounds. At operation at this time the fistulæ were laid open and partially excised. The wounds were packed with iodoform gauze. No communication with the rectum was found at this time. The patient was discharged one month later, having gained twenty pounds, but with sinuses still present extending about two inches into the ischiorectal fossæ. Examination of the tissue removed at operation showed the presence of tuberculosis.

The patient was treated in the out-patient department for six months. He was readmitted because of persisting discharge from sinuses on either side of the anus, and was operated on for the third time October 13, 1920. At this time a horseshoe fistula was found involving both ischiorectal fossæ, on the left side extending through the levator ani. The fistulæ communicated with each other behind the rectum, but no opening into the intestine was found, although the fibrous tissue which made up the outer wall of the

fistula infiltrated the internal sphincter. There were many short lateral tracts extending from the main sinus.

After injection of the sinus with methylene blue a thorough dissection was made extending on the left side through the levator ani, removing completely all of the fibrous wall of the fistula in the ischiorectal fossa. It was impossible to completely remove the scar tissue above the levator ani, and the remaining portion of the tract was cauterized with carbolic acid. The wound was packed widely open with iodoform gauze. The operation took two hours and a quarter. The patient's condition at the end was satisfactory. During the following month the patient was dressed every three days under gas anæsthesia. It was found that the cavity closed steadily from above. At the end of six weeks there were two small sinuses extending up about two inches, still communicating with each other behind the rectum. Eight weeks after operation it was found that the wound on the right side was entirely healed, but on the left side there was a communication into the rectum at the mucocutaneous junction. This tract was excised in a fourth operation December 13th, two months after the preceding procedure. It was then found that in addition to the superficial fistula there was a short tract leading upward beneath the mucous membrane.

He was discharged three months after his admission, with the wound on the right side healed while on the left side there was a small superficial sinus. This was treated in the out-patient department and gradually closed, healing four months after discharge from the hospital. He has been seen at intervals in the last twelve years.

His general condition has always been good and at no time either in the hospital or in follow-up has there been any evidence of pulmonary tuberculosis. He was now presented in connection with Doctor Berry's paper to emphasize the fact that cure in cases of this sort is possible with a radical operation and careful post-operative treatment.

PERI-ANAL TUBERCULOSIS

Dr. Frank B. Berry read a paper with the above title for which see p. 593.

Dr. Henry W. Cave said that Doctor Berry had clarified in the mind of many this whole subject of peri-anal tuberculosis. He had dispelled the myth that practically all cases of fistula in ano were tuberculous in origin. From the literature of others in recent years and from his own experience, Doctor Cave has found that most cases of fistula in ano are due to pyogenic infection and that only from 5 per cent. to 10 per cent. are tuberculous. One often finds hæmorrhoids where there is a co-existing fistula. Neglected hæmorrhoids are a source of infected crypts and it is usually in an anal crypt that the internal opening of the fistulous tract is found. Doctor Berry admits that in active pulmonary tuberculosis probably 75 per cent. or more are likewise tuberculous, but that in the arrested cases only 15 per cent. to 20 per cent. are tuberculous. The increased incidence of peri-anal tuberculosis in sanitoria where tuberculous patients are hospitalized is striking. At the Roosevelt Hospital in a twenty-three and a half-year period, from 1910 to the present time, they have operated upon 1,148 patients with peri-anal lesions exclusive of hæmorrhoids or new growths: twelve of these were cases of proven tuberculosis; fistula in ano, 550; ischiorectal abscess, 481; fissure in ano, 106; ulcer of anus, 11. They have not done guinea-pig tests

nor isolated tubercle bacilli from the secretion of the lesion, diagnosis being made from the microscopical slides. There were seven other cases in the records diagnosed as peri-anal tuberculosis, but after the present pathologist went over them they were thrown out as inconclusive. Of these twelve cases two were suffering from active tuberculosis, six were in a quiescent stage and in four cases no mention was made of any tuberculous process co-existing in any other part of the body. Ten males, two females; ten were fistula in ano, one anal ulcer, and one anal ulceration associated with tuberculosis of the last two inches of the rectum and anal openings; that patient died seven days post-operative from peritonitis; resection of the rectum had been attempted. Doctor Cave said that he had used the reverse Trendelenburg or jack-knife position advocated by Doctor Buie as most convenient in operating upon the anus and rectum. Surgical excision is assuredly the method of cure and should be attempted on all these cases. Doctor Buie has a record of 72.5 per cent. cures which is creditable. The secret of success in operations for fistula in ano depends upon two things: first, complete excision of the true internal opening of the tract; second, no matter how far the incision may run over the buttocks the tract should be left wide open and packed each day from the bottom up until the granulation tissue practically comes to the level of the surrounding skin. Medium-sized tape is pressed down with the finger or flat instrument into the tract. Usually in these cases Doctor Cave has used spinal anæsthesia or novocaine anæsthesia without any mishap. In regard to Doctor Berry's statement that the bowels were not allowed to move for five or seven days, Doctor Cave had abandoned that practice as obsolete and advises the instillation of oil the afternoon of the operation and an oil enema the following morning. Hot fomentations over the anal opening and frequent oil enemas are most comforting. It is a pity that more care is not taken in these cases of peri-anal tuberculosis who are generally left to the house surgeon at the end of the schedule and without proper guidance and supervision of an attending surgeon.

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Remittances for Subscriptions and Advertising and all business communications should be addressed to the

ANNALS OF SURGERY
227-231 South Sixth Street
Philadelphia, Penna.